Australian Government
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IBSA
Innovation & Business Skills Australia

ICT02 Telecommunications Training Package

Volume 3 of 4
Skills and Knowledge Register

Volume 1: Introduction, Qualifications Framework, Assessment Guidelines
Volume 2: Telecommunications Units of Competency
Volume 3: Skills and Knowledge Register
Volume 4: Technical Assessment Records

This volume comprises part of ICT02 endorsed components. It is not to be used in isolation, but needs to be used in the context of the whole Training Package.

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ISC INDUSTRY SKILLS COUNCILS
Creating Australia's Future

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Level 2, Building B, 192 Burwood Road
Hawthorn VIC 3122
Phone: +61 3 9815 7000 Fax: +61 3 9815 7001
www.ibsa.org.au e-mail: reception@ibsa.org.au

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Contents

Group 2 Skills & Knowledge

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AA200**	Dismantling Aerial Cable – Overview	This topic is meant to provide trainees with information to cover the instances where Aerial Cable or Lead-ins are replaced and the existing cable is dismantled and recovered. • Liaison Officers' role, notice of intent • Safety precautions (a) on roads (b) on or near railway property (c) on or near electricity poles. • Obligations to property owners, removing cable ties and terminations, temporary stays, using rope guards • Disposal of recovered goods, ownership of materials, reinstatement of any excavations, release statement
200	**AA201**	Erecting Aerial Cable	This topic covers the different installation methods used to erect Aerial Cables in the network. • Choice of side – road, property side, (explain reasons) • Laying out cable runs, protection against damage, Repairing slight damage to sheath. • Erecting cable by hand. • Inserting twists in cable, reasons and spacing. • Tensioning cables, conforming to sag of other cables, sag tables • Using cable grips, or other mechanical aids • Clearances above ground
200	**AA202**	Poles, description & use	This topic covers the types of poles, which are acceptable for use or are existing in the Access Network. • Types of poles, classes and length • Precautions when handling treated poles • Depth setting disc, location and information details • Installation (overview), locating, staying and backfilling • Stresses exerted on poles, wind loading
200	**AA203**	Terminating Aerial Cable	This topic covers termination methods used for different types of Aerial Cable construction and pre-termination requirements. • Methods of attachment used, preformed terminations • Termination of bearer at pole, in line and angle poles • Attaching cables to intermediate poles

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AA204**	Aerial Cable Construction – Overview	This topic covers the various situations where the Access Network utilises Aerial Cable Construction to supply copper network services to its customers. • When and why used, where not applicable • Access Network owned pole routes, ITP's and Aerial cable construction • Construction alternatives – Span-by-span, Multi-span • Urban, Rural and private property areas • Access Network owned pole routes, ITP's and Aerial cable construction • Sharing with other Authorities
200	**AA205**	Aerial Cable Fittings	This topic covers the types of fittings used to erect and secure Aerial cables, which are acceptable for use or are existing in the Access Network. • Description, sizes, where used. • Location of fittings on poles • Additional Fittings for Joint Use construction
200	**AA206**	Aerial Cable Types – Make-up	This topic covers the types of Aerial cables, which are acceptable for use or are existing in the Access Network. • Cable Types, Sizes (including obsolete types still in Access network) • Cable make-up – Bearers, sheathing, conductors and MB/screen/drain wire
200	**AA207**	Aerial Lead-in Cable (ALIC)	This topic covers the installation of customer's aerial lead-in cable. • Types of ALIC (current and obsolete) • Fittings used at pole, requirements, protecting ALIC, jointing boxes, riser pipe, mower guard (underground feed) • Fittings used, attaching to customer's premises, ground clearances • Joint Use/Common use obligations and restrictions, EL separations, earthing bearer • Terminating bearer, removing bearer to reach terminal points, cable entry to buildings, customer lightning protection
200	**AA208**	Aerial Lead-in Cable – Installation Practices	This topic covers the erection and termination of Aerial lead-ins. • Safety precautions, include private property poles • Clearances from ground, electricity and obstructions • Bearer termination, fittings and practices • Running Aerial Lead-in Cable (ALIC), include span to span • Terminating conductors at customer premises and poles

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AA209**	Aerial Safety (OH&S Requirement)	This topic covers safety precautions required when working at a pole or dwelling. • Pole safety, working in the vicinity of EL, clearances • Ground clearances, road, footway, driveways, private property • Ladder safety – pole and at customer's premises, eg. against walls and gutters etc.
200	**AH200**	Cable Hauling Practices	This topic covers the setting up, attachment and installation of cables • Communications • Attaching hauling ropes, Cable grips • Hauling Lubricants • Protection of Cables during hauling • Controlling Hauling Tensions • Lay-up of cables in Pits or Manholes, Sealing ends, Checking for Pressure (air cored cables)
200	**AH201**	Duct Selection & Preparation	Duct selection should already be covered on the plans provided for the cable installation, however, students should be made aware of the types of problems, which might be encountered. eg. Overhauling other cables, blockages, etc. • Rodding and Proving of Ducts (existing/occupied conduits) • Ropes and Winching Cables • Clearing Obstructions • Positive Pressure Roping
200	**AH202**	Distribution area Plans & Plan Symbols	This topic will utilise copies of DA or Conduit Plans and Symbol Sheets provided to enable plan reading and interpretation of Access Network plant. • Interpreting plans, Streets, Pillar location, North Point, etc. • Symbols used. • Identification of plant eg. Pits pipes, lead-ins, etc. • Allocation of Utilities, footway alignments. • Importance of correct information, updating plans. • SDAN Construction, new cable installation, interpretation
200	**AH203**	Introduction to the Customer Access Network'*'	This topic is easier to convey to students if access to a distribution area within the Access Network can be obtained, close to the training venue. A short field trip which involves opening, viewing and explaining different types of plant (cables and conduits) in the DA. • Make up of CAN (overview) • Cables, Conduits/Pipes, Manholes/Pits, CCU's, etc. • Briefly explain how a customer is linked to their local exchange, concentrating on the distribution side of the network.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AH204**	Hauling Preparations.	This topic deals with the preparation practices required prior to installation of cables. • Care of Existing Plant, Safety Requirements • Cable Types and Handling Methods • Hauling Techniques, Direction of Haul and Equipment • Handling and Setting up Cable Drums
200	**AH205**	Lead-in Cable Installation Practices.	This topic deals with the installation, fittings and jointing of 2 pair lead-in cables. • Location and Fitting of Sealed Wall Box • Utilux 2 pair Enclosures – installation practices
200	**AH206**	Setting up Work-site, Approvals & Requirements	Prior to commencement of any Cable Hauling or associated works, it is necessary to ensure all approvals and safeguards are followed • Local or State Government and Statutory Requirements • Safety Equipment, Barricading, Road-works Guarding, etc
200	**AI200**	Building Construction	This topic covers the types of building construction, which may be encountered when pre-wiring or cabling customers premises. • Types of construction, brick/concrete block, concrete tilt slab, steel, timber • Make-up of framework (studs, joists, noggins, etc.) • BCA restrictions, drilling/notching framework
200	**AI201**	Cabling – Mandatory Separations	This topic covers the requirement to maintain adequate separations from other utilities internal wiring/conduits/ fittings • Separations required from electrical, gas, oil and water services • Methods employed to ensure minimum separations are maintained
200	**AI202**	Cabling - Pre-wiring	This topic covers the current rules/guidelines for telecommunications cabling of customer premises. • Wiring regulations • Suitability of cabling locations, future maintenance • Pre-wiring during construction • Cabling post construction • Installation of drip points in cabling • Locations of stud brackets, height, separation, marking
200	**AI203**	CLP Installation Techniques	This topic covers the various installation techniques included in Appendix 42 • CLP Installation, Techniques No.1 to No.6 inclusive

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AI204**	CLP Materials List	This topic will cover the materials required for the installation of CLP (all situations) and where they are to be used. Materials: • Encapsulated Protector (S.442/70) • Protector Housings - New sealed wall box, Sealed Lead-in Box (S.77/118) Connector Box (S.77/25) Network Termination Devices and Distributors • Earth Electrode Clips, Earth Clip(S.425/23) and Adjustable Earth Clip(S.425/21) • Line Tap (S.425/36) • Communications Earth Terminal (S.446/66) • CLP Caravan Bracket (S.442/74) • Auxiliary Earth Electrodes, Identification Tags Miscellaneous materials: • Green/Yellow Conductor (S.192/487), Self-Locking Cable Ties (S.269/99), Exterior Grade Paint, Connectors, Moisture Resistant (S.114/96), Mesh Bag (S.438/53), Sealant Tape (S.513/59), PVC Adhesive Tape (S.433/11) KRONE Arrestor Magazine 500V (where 10 pair modules are used to terminate the lead-in) Safety Items: • Lines Test Set No 2 (S.138/66) or appropriate AC voltmeters • Medium or Light Weight Rubber Gloves, Rubber Boots
200	**AI205**	Connector Type (MRC) & Jointing Conductors	This topic covers the type of connectors used to joint cables in SHSJ joint enclosures and the precautions, use and care of tools when jointing cables. • Connectors, description and make-u • The electrical qualities of connector jointing • Hand Crimping Tools, description and use (parallel jaws • Checking connection, visual, eg connector cap fully compressed etc. • Tool care and maintenance. • Tool safety precautions handling

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200	**AI206**	Construction Guidelines for Lead-ins	Guard wire performance does not critically depend on rigorous standards. However, the following points should be observed: • Install the guard wire at approximately half the cable depth. Keep the guard wire out of contact with the cable jacket. • Jointing stainless steel guard wire, using jointing sleeves and crimp tool • Corrosion protection of the joints, use of Denso 300 paste, Denso 600 tape and 931 PVC over wrap. • Copper guard wire use sleeve (S.064/00086) C2.84J. No corrosion protection is warranted.
		(continued from previous page)	• At cable joints and manholes, separation from Network • Lead-ins crossing roadway • At the end of lead-in cable runs • At creek crossing (or similar impediments) curving away from the cable. • It is not necessary to extend the guard wire beyond buried cable sections.
200	**AI207**	Fixing to wall surfaces	This topic covers the attachment of fittings to various wall claddings, which may be found in customers' premises. • **Note:** The fixing devise used must provide the ability to remove screws from the sealed lead-in box to access conduit entries at a later date. • Brick - single, double, cavity and facing • Sheeting – plasterboard (gyprock), asbestos, plywood, timber, etc. • Tiles and laminates • Precautions, indemnity forms (covering unavoidable damage caused from addressing customer's request for location of equipment/installation)
200	**AI208**	General Requirements When Installing Auxiliary Earth Electrodes	This topic covers the special circumstances and conditions for the installation of auxiliary earth electrodes. • Installed outside the building such that it is exposed to the weather. • Vertical electrodes, driven to a depth of at least 1.2 metres. • Horizontal electrodes, buried to a depth of not less than 450 mm, exceptions • Bonding conductor connection, coating of exterior grade paint (where above ground), wrapping connections (where below ground), use of grey sealant tape and PVC adhesive tape • Labelling bonding conductor, identification tag (S.141/00397) where it is connected to an auxiliary earth electrode.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AI209**	Guard Wire – Basic Installation	A guard wire is an uninsulated electrical conductor laid in the ground above and along the length of a telecommunication cable. • Use of 2.5 mm stainless steel wire (S.062/00034 or 25) or where otherwise specified copper (S.092/00013 predominantly used in Qld) • Laying in trench, height above cable, precautions • Additional guard wire near trees
200	**AI210**	Health & Safety (Revision)	This topic covers the types of hazards, which may be encountered during a service installation at a residential or small business premises. • Hazardous areas, typical building sites, new estates, areas where a phone cannot be installed • Confined spaces (working in ceilings etc.) • Precautions – electrical, gas, plumbing
200	**AI211**	Installation of Modules & Network Cabling	This topic covers the installation of modules on the A side of BD/CD and the preparation and termination of the Network Lead-in cable. • Installing Krone modules, 10 pair, 11 way frames (or later developments from manufacturers) • Forming cables, fanning out units/pairs, colour code • Use of Krone terminating tool, terminating cable pairs on modules • Installation of Protection cassettes (arrestor magazine) • Requirement for earthing facility if over-voltage protection modules are fitted • Tagging/Labelling modules
200	**AI212**	Installation Practices For CLP	This topic covers the practices for: • Installing the Protector Housing (Refer to Appendix 5 for the lead-in protector housing installation and lead-in cable termination requirements) • Installing the 6 mm^2 (7/1.04) green/yellow bonding conductor • Connecting the bonding conductor by a clip to the protective earth electrode (refer topic 13) • Installing a communications earth terminal (S.446/00066) – where required • Connecting the bonding conductor to the main earthing conductor *outside* the electrical switchboard
200	**AI213**	Installations of Rural Lead-in Cable (HJ)	This topic covers the methodology of installing rural lead in cable (HJ) • Customer provided trench, suitability, dimensions • Laying cable in solid • Installation in conduit (where required at house end), methodology • Installation of guard wire, position above cable (Note! Segment 6 for detailed training in Lightning Protection)

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AI214**	Installing Aerial Lead-in Cable (ALIC)	This topic covers the methodology of installing an ALIC to a customer's premises and the building termination and cabling requirements for customers aerial service feeds. • Fittings used, at pole – at house, additional fittings if required (risers) • Installation of Protective pipe (for cable protection at pole) • Structural support for terminating bearer (IBC) • Erection of ALIC, clearances (ground & electrical), termination of bearer • Use of Sealed Wall Box, Conduit & Cabling to wall box, Drip points
200	**AI215**	Installing CLP on a Caravan	The CLP installation technique described in this topic is suitable for any caravan powered by a flexible extension cord. The practices detailed here are **not suitable** for use in a caravan park. • Temporary CLP Installations on Caravans • Materials required • Installation Steps required; • Checking for hazardous voltage, installation of auxiliary earth electrode, modification of wall box S.077/00121, fitting of caravan mounting bracket assembly. • Arrangement of earth wire, lead-in cable and encapsulated protectors inside protector housing
200	**AI216**	Installing CLP on Distributors	• The principles and specifications for installing CLP on distributors or other similar blocks are similar to those detailed in appendix 42. However, where KRONE IDS modules are involved then KRONE Arrestor magazine S.537/00136 (500V arrestors) shall be used. Refer to Appendix 5 Part 3 for details.
200	**AI217**	Introduction To Customer Lightning Protection	This topic covers a summary of The Access Network's CLP Policy (reasons, roles and responsibilities) and the requirement for Contractors working in the Access Network to observe these requirements. (See information in the Attachments section of this document) • Customer Lightning Protection Policy (Summary) • Contact Points within Access Network, phone numbers • Access Network's Liability for lightning damage

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AI218**	Jointing Pit – Installations (Private Property only)	This topic covers the types and installation practices of pits, which may be installed in a rural lead-in on private property. • Viscount – P2 plastic pits • BTR – P5 plastic pits – where required for larger conductors/Hard jacketing • Concrete type pits – where required for ground/soil types • Pit installation practices, installing pipe (where required) • Backfilling and reinstatement
200	**AI219**	Lead-in Cable Installation Practices	This topic deals with the installation, fittings and jointing of 2/5 pair lead-in cables. • Hauling lead-in cable, 3 mm hauling line (Coil of cable provided in the pit) • Housing cables in Sealed Wall Box, CUE (if utilised) • Pair identification of 2pr./5pr. cables • Using MRC connectors • Utilux 2 pair Enclosures, installation practices • Sealing lead-in cables, use of Heat-shrink end caps
200	**AI220**	Lightning Incidents	This topic covers the explanation and reporting of Customer Lightning Incidents back to the appropriate area within Access Network. • Description of Customer Lightning Incidents • Description of Property Lightning Damage Incidents • Reporting details, information required (Report Form for alleged Customer Lightning Incident)
200	**AI221**	Location of Distributor	This topic covers the acceptable locations for the positioning of BD/CD. • Outdoor positioning rules • Indoor positioning rules, Commercial Buildings or Multi-Tenant Residential Buildings, Single Dwellings • Requirement for Intermediate Wall Box
200	**AI222**	Maintenance/ Alterations at NBP	This topic covers the maintenance of existing customer installations or alterations/additions that may be required. • Replacement of existing sockets, obsolete fittings • Linking existing apparatus to new sockets • Maintenance of CLP Installations
200	**AI223**	MDF Jumpering	This topic covers the running of jumper wires at an MDF • 2 pair pre-jumpered rule, A to B side • Selecting nominated pairs • Running jumper wire through appropriate guides • Terminating jumpers, use of appropriate tooling (B side may have some other type/brand of module) • Entering details in BD/CD record book

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AI224**	Outlet Types & Applications	This topic covers the types of internal fittings used to terminate wires and provide apparatus access to the network • Mounting plates, types and applications • Type 610 socket • Modular sockets, 6 way, 8 way, types and applications • Wall phone brackets, use in conjunction with modular sockets
200	**AI225**	Repair, Raising or Lowering Pits	This topic covers pits, which do not conform to the surrounding ground levels, depth requirements of conduits or pits, which may have slight damage (which makes them unsafe or unserviceable) **Note:** The re-siting of pits along the street cabling route will possibly mean replacement of exiting joints, this activity must be carried out by an accredited Advanced Cable Jointer. • Asbestos Removal and Disposal (review) • Working with Cement/Fibrous Pits • Working with Plastic Pits • Pit Repairs, use of Concrete Pit Collars
200	**AI226**	Rotational Pairs – Colour Codes	This topic covers the make-up of pairs/units (rotational) within a cable sheath. • Rotational pair structure, reading of cable sizes (10 & 30 pair) • Matching rotational pairs to connected (allocated) pairs. • Practice reading Small Rotational/Connected cable pair ranges. • Examples of CPFUT - HJ cables used in for rural lead-ins shall be made available as a visual aid.
200	**AI227**	Safety Precautions When Installing Auxiliary Earth Electrode	This topic covers possible additional safety precautions and requirements to that covered by the OH&S pre-requisite knowledge. • For staff safety, and to prevent damage to underground services, always check for the location of underground power cables, water and gas services. • Indicators used as a guide to the presence of underground power: • No overhead power feed to building, EL Riser cables on power poles, existence of Power pedestals, underground power cable lead-in, power cables to outbuildings, swimming pools, garden lights, electric barbecues, external power points, etc.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Precautions to be followed: • Consult the property owner re: location of underground services, check available site plans, visual inspection of site • Verify the location of services, use of cable locators, potholing • Required electrode separations from other utilities • Personal safety requirements and actions
200	**AI228**	Selecting the Best Bonding Arrangement	This topic covers the determination of the best bonding arrangement for a particular situation, (the priority is to lay out the lead-in cable so that the building entry point is well within 10 metres of the protective earth electrode, the main earthing conductor or the electrical switchboard). • Basic CLP Installation • Retro-fitting CLP to existing service (where changes to lead-in occur)
200	**AI229**	Special Arrangements for Rural Customers	This topic deals with scenarios specific to customers' services in rural locations. • CAN Radio Installations • Enhanced Protection for Rural Customers, rural cables with a severe and consistent history of lightning damage to cables.
200	**AI230**	Supply of Distributor Hardware (Responsibilities)	This topic covers the responsibilities/arrangements for the supply of all BD/CD fixtures (excepting the A side terminals) • Customer or Builder's cabling provider • Contractor's private arrangement with customer, outside Access Network's contract • Access Network's responsibility, A side – supply and termination of modules Exceptions: • (There will be cases where the contractor will be directed to provide a distributor on The Access Network's behalf for the sake of commercial expediency; however, this shall not be done without specific instructions from The Access Network).
200	**AI231**	Termination of Conductors	This topic covers the termination of cabling at the equipment or cable interface. • Wiring diagrams, single and multiple outlets (multiple outlets require the operator to possess an ACA licence) • Pair identification of 2pr./5pr. cables • Terminating, IDS terminals or screw terminals • Using MRC connectors

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AI232**	Testing For Hazardous Voltages	Faults occurring in the customer's electrical installation can produce hazardous voltages on the protective earth system. Mandatory electrical testing for this potential hazard must be followed before commencing any installation, maintenance or testing of CLP equipment. • Test instruments used, LTS No.2 (preferred), AC Voltmeter • Recommended testing procedure; • Preparing the temporary test earth electrode, placement of the earth electrode, observing safety precautions, carrying out test • Actions taken when hazardous voltage detected
200	**AI233**	Trenching, including Sharing Trenches with Other Utilities	This topic covers all aspects of providing a lead-in trench (where necessary) and the rules for sharing trench with other utilities. • Preparations and approvals, prior to commencement of work. • Trenching Safety, Barricades, Road-works Guarding, etc. • Route requirements, Depth of Cover, Access Network alignment • Backfilling (where required) • Sharing Trenches – Agreements
200	**AI234**	Underground Lead-in to Low Level Box (Stobie Pole)	The pre-provisioning practices **inside** the property boundary will remain the same as for **Segment 1, part 1 information**. Existing network pit: • If a pit is available (prior to Low Level Box) to connect the lead-in pipe to the network, the practices will be the same as for Segment 1. Feed the lead-in cable to the low level box through the existing pipe. No existing network pit: • If an adjacent customer's lead-in pipe connects directly to the appropriate Low Level Box then either: Install a new pit in the footpath to intercept the existing lead-in pipe, connect the new lead-in pipe to this pit and use the existing section of 20 mm (up the pole) to feed the lead-in cable to the low level box. **OR** • Install the new 20 mm lead-in pipe across the footpath to the base of pole, fit a 305 mm bend at the base of the pole. Attach the 20 mm pipe to the pole by removing the existing speed nut and fitting a second pipe bracket over the thread. Fasten with a new speed nut. Position the new 20 mm pipe on the vacant side of the channel (normally the right hand side). Allow sufficient lead-in cable for connection to network in the low level box

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200	**AI235**	Area Lightning Risk Classifications	This topic covers the listing of Distribution Areas (DA's) classified as being higher than normal risk. • Obtaining information on DA's (Contract Manager, Liaison Officer – Intranet access is required)
200	**AJ200**	Cable Housing & Sheath Removal	This topic covers the flow of cables and joint position in pits and preparation of cables for jointing. • Cable/joint/pit/pipe combination chart • Correct handling and housing of plastic cables • Termite protection - hard jacketing, termite shield tape (protecting in-lines) • Selection of cable sheath removal tools • Safe operation of cable sheath removal tools • Exchange side cable identification (forming and taping)
200	**AJ201**	Cable Joint Enclosures, Types Sizes & Applications	This topic covers the type of current joint enclosures to be installed in new work and obsolete enclosures, which may be still existing in the Access Network. • Sealed Heat Shrink Joint enclosures – All Sizes, (SHSJ) • In Line enclosures • Utilux 2 Pair Joint Enclosure, (covered in Cable Hauling course) • TJK5 – 2 pair in-line • Pedcap and SAM's (SDAN) • Above Ground Jointing Post (EJ) • PVC Openable • LSTOJ (Large Screw Type Openable Joint). • Radii Openable • Non standard Joints
200	**AJ202**	Cable Pair Identification, Use of ID Instruments	This topic covers, Loop a Line, F Set, GP Sets or other approved equipment which may be used to identify cable pairs/legs in the Access Network. LOOP-A-LINE, F SET (CZ1000); • Description and application of Cable Pair Identifiers • Identification, Using null • Removing tone • Looping the line • Precautions and maintenance of equipment PAIR IDENTIFICATION & INTERCOM SETS; • Description and application • Checking operation, battery levels • Establishing communications, Setting up • Identification signal, frequency selection • Using as a receiver for pair identification • Mode switch • Receive level meter

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Use of probe • Leg identification • Precautions and maintenance of equipment
200	**AJ203**	Conduit – Types, Fittings & Applications	This topic covers the conduits installed in the Access Network and the use of various fittings which are associated with conduit installations. • Conduits used in Distribution Areas • Standard Conduits – Application and Description • Fittings – P.V.C. Bends, Couplings and Bushes • Joining Conduits • Installation into Pits and Manholes • Installation of Sealed Wall Box • Installation of Riser Pipes, Mower Guards (for Aerial) • Proving and Repairing Conduits
200	**AJ204**	Connector Jointing.	This topic covers the precautions, use and care of tools when jointing cables. • Hand Crimping Tools, Description and use • Selecting the correct tool and settings. • Testing Crimp height. • Description and application of each item of cable jointing tools and equipment. • Tool Care and maintenance. • Tool safety precautions handling • MVS3 crimping tool for In-line joints • AMP Stack In-line Connector tool
200	**AJ205**	Connector Types & Uses, Butt, In-Line & Modular connectors	This topic covers all types of connectors used to joint cables in joint enclosures • Connectors, Description, make-up and selection • The electrical qualities of connector jointing • AMP Picabond connectors • AMP (modular) Stack connectors
200	**AJ206**	Cross Connect Units (CCU's), Pillars/RIM's/ RCM's	This topic covers the cross-connect units positioned between Main/Optical Fibre Cables and Distribution Cables in the Access Network. • CCU overview • Application of the KRONE Systems • Testing unit seal, when opening and closing • Reading of pillar strip, Krone and Tailed terminal units • Installing additional tails (up to 200 pr filled cable) • Reading of RIM terminal units • Reading of RCM terminal units • Run jumper and solder jumper • Run jumper and terminate using IDS tool • Quante IDS, CCU terminal units, Installation and Use • Termination of BD's, rural lead-ins – Krone

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200	**AJ207**	Customer Lightning Protection (CLP) – awareness	This topic covers the need for CLP on customer services • Policy for fitting of CLP • Areas where CLP is required • When CLP must be fitted/retro-fitted.
200	**AJ208**	Cut-over & Maintenance Kits	This topic covers the selection and installation of Cut-over/Re-make joint enclosures • Correct closure selection. (small, large & extra large) • Small pit (C type) cut-over enclosure, shaved clamp • Kit components • Joint closure installation • Cable preparation • Screen continuity (MB) • Gel dams for Air-cored cables • Inserting conductors • Installing Heat-shrink sleeves • Sealing the CAN
200	**AJ209**	Distribution area Plans & Plan Symbols	To enable plan reading and interpretation of Access Network plant, this topic will utilise copies of DA or New Estate Plans and Symbol Sheets provided. SDAN (formerly FMS) plans should now also be used. • Interpreting plans, Streets, Pillar location, North Point, etc. • Symbols used. • Identification of plant eg. pits, pipes, aerial (if available), lead-ins, etc. • Cable types/sizes, pair ranges, etc. • Importance of correct information, amending and updating plans.
200	**AJ210**	Distribution Cables, Types, Sizes & Applications	This topic covers all current Urban and Rural distribution cables and raises awareness of obsolete cable types still in use in the Access Network. • Types of cables, Sheath, Conductor and Insulation types • Current and Obsolete Colour Codes, (including air cored twin, quad and layer twin/German) • Screened cable, continuity wire and earthing • Lead sheathed cables • SDAN cabling and Service Access Modules (SAM's) • Examples of the various cables used in the distribution network shall be made available as a visual aid.
200	**AJ211**	Fault Conditions & FAST Testing	This topic covers the types of faults and environments able to be tested by FAST and guidelines for interpretation of the results. • Types of faults, systems which prevent FAST access • Causes and effects • FAST Testing and interpretation of results

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AJ212**	Installation of Sealed Heat Shrink Joint Enclosure	This topic covers the selection, preparation and installation of cables into a butt ended joint enclosure. • Correct Joint size selection. (small, large & extra large) • Kit contents check • Cable Sheath preparation, (Clean, Abrade and Flame Bush - Fit aluminium foil) • Marking cables for installation. • Jointing Jig set-up and use. • Shrinking base and auxiliary sleeves • The importance of cable pair retention for identification • Looped cable pairs/units • Application and fitting of collets • Recognition of EPR Zones • Precautions when working on Joints in EPR Zones • Rural – Moisture Barrier (MB), continuity/earthing
200	**AJ213**	Installation of XAGA 550 In-Line Joint Enclosure & Encapsulation of Conductors	This topic covers the selection, preparation and installation of cables into an in-line joint enclosure. • Correct XAGA 550 Kit section • Kit contents check • Cable Sheath preparation, (Clean, Abrade and Flame Bush - Fitting foil) • Preparing cables for jointing, continuity wires • Jointing set-up • Jointing and housing of connectors • Encapsulation of joints – Kit installation, RSS compound (amount required) • Fitting inner container • Shrinking sleeve, indicators • Housing cable and joint in pits
200	**AJ214**	Introduction to Basic Electrical Principles	This topic covers information on Basic electrical theory which provides the trainee with the knowledge to understand the electrical operation of the Access Network and electrical specifications, when dealing with working service provisioning or faults. This session involves the definition and application of the following theories: (Simplify information where possible) • Units of Electricity • Electromotive forces, methods of generation and levels in the network • Resistance, types, causes and effects • Insulation, types and properties • Conductors, types and properties • Ohms Law, definition and application • Standard Line conditions

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AJ215**	Introduction to the Customer Access Network '*'	This topic is easier to convey to students if access to a distribution area within the Access Network can be obtained, close to the training venue. A short field trip, which involves opening, viewing and explaining different types of plant in the DA. Concentrating on: Cable types, Joint enclosure types, Construction (aerial or underground), Pillars, etc. • Make up of CAN (overview) • Cables, Conduits/Pipes, Manholes/Pits, CCU's, etc. • Briefly explain how a customer is linked to their local exchange, concentrating on the cable sizes, pair ranges, back-feeding lead-ins, etc. on the distribution side of the Access network.
200	**AA210**	Joint Use Construction	This topic covers the erection of Access Network's Aerial cable on a Power Authority pole route. • Normal joint use – LV poles (could have HV above LV) • Common use poles • Special joint use, agreements between Access Network and Power Authority • Permitted cables, earthing of bearer wire, fitting shrouds, attaching fittings • Clearances from Low and High Voltage • Clearances, Copper CAN and Broadband Cables • Banding methods and use
200	**AJ217**	L.P.G. Equipment	This topic covers the precautions required and use of Liquid Petroleum Gas • LP Gas, Description of equipment, setting up and closing down. • Safety Precautions when handling LP Gas equipment. • Use of LPG equipment on Fire Ban Days
200	**AJ218**	Pole Mounted Joint Enclosures	This topic covers the Types, Uses and Installation practices for pole mounted joint enclosures and information on existing obsolete enclosures still in use in the Access Network. • Application, ITP and Aerial Cable construction • Pole Mounted Joints - Capacity • New installation of E31D and E31A Joint Closures • Installation of E31D and E31A during rehabilitation work • Rehabilitation of Untailed Terminal Box • Pole mounted enclosure – South Australia • Screening, continuity, when to earth continuity • Use of HSOJ's (E32C/R's) mounted on poles

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AJ219**	Re-entry of an In-Line Joint	This topic covers the method of re-entering previously sealed in-line joints to add additional cables or to repair faults. • Additional tools required • Precautions for removal of In-line Sleeve • Removal of In-line sleeve and preparation of cables for new sleeve.
200	**AJ220**	Re-entry to Sealed CAN Joints	This topic covers the methods of re-entering previously sealed joints to add additional cables or to repair faults. • Method of Re-entry and Precautions required • Selection of rehabilitation kit (prior session revisited) • Re sealing of Joints
200	**AJ221**	Replacement/ Alternatives for Above Ground Jointing Posts (EJ's)	This topic covers the methods to be used for the replacement of existing Above Ground Jointing Posts or Elevated Joints (EJ's),which can be in many and varied forms. • Identifying different types of EJ's • Urban location: Re-positioning of joint into SHSJ in a pit • Rural location: Remake in SHSJ at post and Overlay (good insulation/same site) • If insufficient good insulation, Install SHSJ in pit or • Install Buried In-line joint
200	**AJ222**	Rotational & Connected Pairs	This topic covers the make-up of pairs/units/layers (rotational) within a cable sheath and the method of designating pair ranges (connected) to those cables. • Rotational pair structure and cable sizes • Rotational reading of Small and Large size cables, (Appendix 37 Large Size) • Random jointing of cable pairs overview. • Allocating pair ranges to distribution cables. • Matching rotational pairs to connected (allocated) pairs. • Practice reading Small Rotational/Connected cable pair ranges. • Examples of the various rotational cables used in the distribution network shall be made available as a visual aid
200	**AJ223**	Sealed CAN Practices	This topic covers the methods used to seal completed butt ended enclosures against the ingress of moisture. • Housing of jointed conductors within enclosure shells • Sealing joints with GEL • Housing cable and joint in pits, support bars • Tagging and Labelling joint enclosures • Purpose and application of Network sealing • Precautions working with encapsulant GEL • Precautions and disposal of unused GEL • Uncured GEL, handling and disposal methods

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• GEL spill, precautions and clean up • New work and rehabilitation practices • Utilux 2 pair Joint Enclosure • TJK5 2 pair joint closure
200	**AJ224**	Working Cable Precautions, including Special Services & Pair Gain Systems	This topic covers the precautions which must be followed when entering working cable joints/pairs and Prior Notification which must be given to avoid customer complaints and interruptions. • Precautions prior to opening Cables. Overview of CPAS, NPAMS, environmental concerns. • Precautions prior to opening cable pairs. • Minimising interruption to customer service when jointing cable pairs. • Management of customer equipment (Fax, Modem, PABX etc). • Procedures to manage and minimise interruptions to Special Services • Special Services, Planned Outages, overview of procedures • Identification and management of PGS, overview
200	**AJ225**	Basic Line Test Equipment	This topic covers the basic test instruments, which the student may be required to use or may encounter whilst assisting an advanced jointer in the distribution network. • Description and usage of **LTS No2** • Scales and calibrations. • Interpretation of readings • Precautions and maintenance • Description and usage of **Digital Insulation Tester** • Scales and calibrations. • Interpretation of readings • Precautions and maintenance • Description and use of **Field Handset** (Buttinski) • **CZ3000** (Eth, F/Batt) and **TS100 PET** (O/C, S/C) – overview only
200	**AP200**	Cross-connecting Units	This topic covers the cross-connect units positioned between Main/Optical Fibre Cables and Distribution Cables in the Access Network. • CCU overview • Application of the KRONE Systems • Testing unit seal, when opening and closing • Reading of pillar strip, Krone and Tailed terminal units • Installing additional tails (up to 200pr filled cable) • Reading of RIM terminal units • Reading of RCM terminal units • Run jumper and solder jumper • Run jumper and terminate using IDS tool • Quante IDS, CCU terminal units, Installation and Use • Termination of BD's, rural lead-ins – Krone

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AP201**	Dangerous Gases, Detection & Actions	This topic is positioned at this point in the course to provide information, prior to a field walk mentioned in the 'Introduction to the Access Network' topic. • Use of Portable Gas Detector (operating procedures) • Types of gases • Checking for gas – when and where. • Action to be taken, when gas is detected. • Safety practices - reticulated gas areas
200	**AP202**	Distribution area Plans & Plan Symbols	This topic will utilise copies of DA or New Estate Plans and Symbol Sheets provided to enable plan reading and interpretation of Access Network plant. • Interpreting plans, Streets, Pillar location, North Point, etc. • Symbols used. • Identification of plant eg. pits, pipes, aerial (if available), lead-ins, etc. • Allocation of all Utilities, footway alignments. • Importance of correct information, updating plans. • SDAN Construction, new cable installation, interpretation.
200	**AP203**	Introduction to the Customer Access Network	This topic is easier to convey to students if access to a distribution area within the Access Network can be obtained, close to the training venue. A short field trip which involves opening, viewing and explaining different types of plant (pits, manholes, etc.) in the DA. • Make up of CAN (overview) • Cables, Conduits/Pipes, Manholes/Pits, CCU's, etc. • Briefly explain how a customer is linked to their local exchange, concentrating on the distribution side of the network
200	**AP204**	Jointing Pit Types, Sizes, Fittings & Applications	This topic covers the types and applications of the various pits, which may be installed in the Access Network. • Pits used in Distribution Areas • Sizes 2, 5, 6, 8, 9 and Fitting of Collars • Linpac Polycast Plastic Pits - Installation Practices • BTR Plastic Pits - Installation Practices • Viscount – P2 plastic pits, private property • Concrete Type Pits - Use and Installation • Working in Pits and Manholes
200	**AP205**	Public Relations, Dealing with Customers	This topic covers the methodology which Contractors must adhere to when dealing with Access Network Customers or members of the public whilst working in the Access Network. • Contractor Responsibilities • Pre - Advice to Customers • Handling Customer Enquiries – Complaints

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**AP206**	Quality assurance	This topic covers the requirement for all work performed in the Access Network to conform to Access Network Standard Work-practices, as detailed in the Schedule A Appendices, prior to Contractor staff handing over the completed task. • Responsibilities of Contractor • Measures, Final Quality Auditing • Checklists, Work Quality Sheets • Tags and Labelling
200	**AP207**	Repair, Raising or Lowering Pits	This topic covers pits, which do not conform to the surrounding ground levels, depth requirements of conduits or pits, which may have slight damage. • Asbestos Removal and Disposal (review) • Working with Cement/Fibrous Pits • Working with Plastic Pits • Pit Repairs, Concrete Pit Collars
200	**AP208**	Rodding & Roping 0f Conduits	This topic covers the methods of installing hauling ropes ready for cable installation. • Care of Existing Plant • Rodding Methods • Ropes, Types and Uses • Positive Pressure Roping
200	**AP209**	Trenching, including Sharing Trenches with Other Utilities	This topic covers all aspects of planning, providing and closing of trenches. • Preparations and Approvals prior to commencement of work. • Soil Types and recognition • Trenching Safety, Barricades, Road-works Guarding, Shoring, etc. • Route requirements, Depth of Cover, Alignment • Bedding and Backfill • Drilling and Boring • Shared Trenches – Agreements
200	**CA200**	Cable installation – general	• General metallic (non-specialised) cables • Internal/ external installations • Cable dispensers, hauling mechanisms • Cable damage awareness • Domestic, commercial installations • ACA requirements • Cable termination preparations • Termination types, frames, outlets • Distributors • Terminations • Jumpering • Common installation tests • Functional and protective earthing • Safe work practices

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**CA201**	Cable termination products – general	• Product termination systems • Product termination techniques • Product termination tools
200	**CA202**	Cable conductor identification codes	• Types of codes • Interpretation of codes
200	**CA210**	Cable support systems	• Plans and cable locations • Wall construction • Fixing devices • Conduit and ducting • Distribution boxes and mounts • Installation techniques • ACA specifications and standards
200	**CA215**	Cable support systems for CAN	Surface construction Fixing devices • types • safety • hazards Fixing conduit and ducting • techniques • skill • regulations
200	**CA216**	Installation of above ground enclosures	• Entry point Identification • Site excavation • Placement of base pad • Conduit connection assembly • Enclosure assembly
200	**CA220**	Cable types	• Telecommunications and data cable types • Purpose, construction, characteristics • Cable identification • ACA technical standards
200	**CA225**	Cable types for CAN	• Telecommunications and data cable types • Purpose, construction, characteristics • Cable identification • Technical standards
200	**CA230**	Copper cable jointing methods	• Cable types, construction • Cable stripping and preparation • Conductor coding, identification • Connecting methods • Connector products • Connector tools and equipment • Screens and earthing • Sealing • Safe work practices • Testing

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**CA235**	Cable jointing for CAN	• Identify components of telephone cables. • Maintain cable jointing tools. • Symbols and plan reading. • Cable pair identification. • Jumper in cabinets and pillars. • Housing plastic cables in pits. • Preparing, jointing and sealing cables. • Continuity testing of cable pairs. • Housing large sized cables. • Preparing, jointing and sealing large sized cables.
200	**CA245**	Cable handling & hauling for CAN	• Preparing for cable hauling • Sub ducting installation • Pressure testing cables • Hauling in cables • Withdrawing cables
200	**CA250**	Cable types – structured cable	• ACA approved • Solid, stranded • Shielded, non-shielded • Applications, selecting cables • Transmission performance • Impact of cabling environment • Distinguish between UTP, FTP and STP
200	**CA251**	Installation methods & terminations – structured cable	• Structured cable installation design principles • Installation practices • Crushing, burning, kinks, cuts, sheath twist, stretching, bending • Securing • Terminations • Frames and sockets • Patch panels
200	**CA252**	Cabling products – structured cable	• Cable systems • Cabling hardware • Frames, sockets, connectors
200	**CA253**	Cable installation testing – structured cable	• Cat 5 testing instruments • Cat 5 installation testing • Interpreting test results
200	**CA260**	Cable types – optical fibre cable	• ACA approved • Single mode, multimode • Internal, external cable • Step and graded fibres • Applications, selecting cables • Loose tube, buffered, armour plated • Contaminants • Transmission performance • Impact of cabling environment

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**CA261**	Installation methods & terminations – optical fibre cable	• Optical fibre installation design principles • Installation practices • Safe installing practices • Min. bending radii, max. hauling tension • Support and securing mechanisms • Cable protection • Termination techniques • Mechanical and splicing techniques • ST/SC connectors • Frames and sockets • Patch panels • Earthing
200	**CA262**	Cable products – optical fibre cable	• Cable systems • Cabling hardware • Frames, connectors • Enclosures/break out boxes
200	**CA263**	Cable installation testing – optical fibre cable	• Optical fibre testing instruments • Optical fibre installation testing • Interpreting test results • Pre-installation testing • Identifying installation faults from testing
200	**CA264**	Optical cable theory	• Optical fibre transmission: principles, properties, advantages, applications • Working with magnification
200	**CA270**	Cable types – co-axial cable	• ACA approved • Hard line, semi rigid • Internal, external cable • Underground, aerial • Powered, non powered • Applications, selecting cables • RG58,59, 11, 2, 3, twin axial, (thick/thin) • Transmission performance • Impact of cabling environment
200	**CA271**	Installation methods & terminations – co-axial cable	• Design principles • Installation practices • Safe installing practices • Support and securing mechanisms • Termination techniques • Connectors: int/ext, pin type, integral pin, separate pin earthing • Frames and sockets • Patch panels
200	**CA272**	Cable products – co-axial cable	• Cable systems • Cabling hardware • Connectors: crimp, solder, mechanical, BNC

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**CA273**	Cable installation testing – co-axial cable	• Co-axial cable testing instruments • Co-axial cable installation testing • Leakage • Interpreting test results • TDR testing
200	**CA280**	Soil types	• Sand rock, clay, soil, mixed • Spoil • Impact of weather conditions
200	**CA281**	Underground installation of enclosures & pipe/conduits	• Cable types • Man hole, pit, trench • Pipes, conducts, ducts: types, materials, capacity • Installation techniques • Sealing • Identification • Labelling • Access • Returning enclosure lids, covers, sealing
200	**CA282**	Cable installation & securing – underground	• Haul and secure cables installation techniques • Locations of jointing enclosures • Bending radii, hauling tension • Identifying cable damage • Cable support brackets, fixtures
200	**CA283**	Cable termination & coding – underground	• Jointing enclosures • Cable stripping and preparation • Conductor coding, identification • Connecting methods • Connector products • Connector tools and equipment • Screens and earthing • Sealing • Safe work practices
200	**CA284**	Cable sealing techniques – underground	• Cable environment protection • Sealing techniques, practices
200	**CA285**	Cable testing – underground	• Cable testing instruments • Underground cable installation testing

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**CA286**	Bricklaying & concrete pouring	• Properties of materials: concrete, loam, sand gravel, steel reinforcement • Tools and techniques • Weatherproofing materials and methods • Foundations: earthworks, packing • Australian building codes and regulations: plans, approval, inspections Note: 1. Enclosures and pads are generally pre-built. Installation requires minimal bricklaying/concreting or construction 2. Larger projects of this nature are contracted to private enterprise
200	**CA287**	Construction principles – layout, drainage, etc.	• Site inspection: geological conditions, drainage • Location: site plans, street plans, construction/ building plans • Construction types: manhole, pit, tunnel, trench, underground pillar, underground enclosure • Enclosure materials: concrete, fibreglass, bricks, concrete panels, plastic, tin • Backfill: rock, sand gravel, soil • Physical works: jack-hammer, excavation, digging, boring Note: 1. Enclosures and pads are generally pre-built. Installation requires minimal bricklaying/concreting or construction 2. Larger projects of this nature are contracted to private enterprise
200	**CA290**	Pole types & aerial service identification	• Wood, concrete and steel poles • Pole soundness: tests, markings • Aerial services: power (high/low voltage), telephony, cable TV • Impact of weather conditions
200	**CA291**	Installation of aerial supports	• Support structures: towers, poles, external walls • Aerial fixing devices: hooks, rings, pipe risers, clamps, brackets • Termination boxes
200	**CA292**	Cable installation & securing – aerial	• Haul and secure cables installation techniques • Hauling tension • Catenary cables • Cable spinning techniques • Identifying cable damage

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**CA293**	Cable termination & coding – aerial	• Customer lead-in • Termination boxes • Cable stripping and preparation • Conductor coding, identification • Connecting methods • Connector products • Connector tools and equipment • Screens and earthing • Sealing • Safe work practices
200	**CA294**	Cable sealing techniques – aerial	• Cable environment protection • Sealing techniques, practices
200	**CA295**	Cable testing – aerial	• Cable testing instruments • Aerial cable installation testing
200	**CA296**	Pole testing	Tests for soundness of poles • Push • Knock • Visual • Dig • Inspect below ground • "Condemned" markings: authorities
200	**CI210**	Communication – 2	• Components of communication • Oral communication: conveying information to clients, colleagues and other site personnel • Written communication: Completing job reports, compliance forms and other forms associated with cabling role
200	**CS210**	Customer relations	• Customer service principles • Communicating with customers • Working with people • Identifying customer needs • Handling challenging customers
200	**EL210**	AC/DC basic theory	• Basic electrical concepts • Effects of current • Resistors • Sources of EMF • Simple circuits • Batteries • Basic measuring instruments

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**EL220**	Earthing systems	• MEN, TELEX, co-axial, equi-potential, functional (TRC) • Cable screening • Colour coding • Interference RFI/EMI • Electrical interference • Lightning earths • Gas arrestors • Over voltage protection
200	**EL221**	Earth testing	• Earth testing instruments • Earth testing procedures
200	**EL222**	Earthing & EPR	• Definition of earthing • A history of earthing • Power system earthing • Equipotential bonding • Earth potential rise (EPR) • EPR in the telecommunications industry • Low frequency induction (LFI) from HV power lines
200	**EL230**	Electric shock	• The body and electricity • The science of electric shock • Current involved in electric shock (This is a short and mainly theoretical topic. Practical management of the circumstances and result of electric shock are covered in other topics.)
200	**EL231**	Limits of approach	• Definition of limits of approach • Working near electrical equipment • Safe approach distances • Safety precautions • Working near other services: safety precautions • Safety precaution checklist • Aerial cabling and standards
200	**EN210**	Enterprise policy & practice	• Policy and practice related specifically to competency unit outcomes.
200	**FA220**	First aid – emergency response	This topic is not a recognised program in first aid and only seeks to create an awareness of procedures in emergency situations. Only accredited trainers can deliver CPR training or recognised first training leading to a registered certificate. • Assessing the scene • Making the scene safe • Obtaining assistance • Managing the injured • Calling for help • Hygiene
200	**IN210**	Teamwork skills	• Work team: purpose, value, organisation • Individuals: purpose, role, behaviours, impact • Characteristics: norms, stages, strategies, barriers

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**MA210**	Basic telecommunications mathematics	• Fractions, decimals, percentages, ratio, proportion • Principles of Budgeting • Budgeting calculations • Estimation • Measurements: units and calculations • Practical applications to telecommunications
200	**OH210**	Occupational health & safety 2	• OHS Act • Hazards • Safety clothing and equipment • Hazardous chemicals • First aid • Heart/lung resuscitation • Manual handling • Ladders and hoists • Fire control and protection • OHS responsibilities and reporting • Electrical tools and safety
200	**OH211**	Safe work practices – structured cable	• Structured cabling installations
200	**OH212**	Safe work practices – optical fibre cable	• Optical fibre cabling installations • Safe handling practices • Termination cleanliness • Safety associated with cable end viewing
200	**OH213**	Safe work practices – co-axial cable	• Co-axial cabling installations • Safe handling practices
200	**OH214**	Safe work practices – underground	• Hazards: gases, toxic fumes, ventilation, environment maintenance, precautions • Working environment • Road and footway guarding • Debris, trees • Temporary cables / services • Regulations: total fire bans, water discharge, vehicle parking • Traffic control • Safety equipment: lights, signs, tapes, guards
200	**OH215**	Safe work practices – aerial	• Hazards • Working environment • Safety belt, lines, ladders • Road and footway guarding • Debris, trees • Temporary cables/services • Regulations: total fire bans, water discharge, vehicle parking • Traffic control • Safety equipment: lights, signs, tapes, guards

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**OH230**	Hazard management	Workplace hazards: • Gases and fumes • Sharp objects • Lighting and ventilation • Roadway and footway guarding • Removal and storage of rubbish and debris • Installing temporary cables • Asbestos products • Safe weather conditions • Hazard management • Three steps in hazard management • Hierarchy of control methods • Worksite inspections • Job site assessment or job safety analysis (JSA) Hazard management techniques: • Tagging • Confined space
200	**OH240**	Personal safety equipment	• Hard hat • Clothing • Gloves • Footwear • Accessories • Safety belt
200	**OH250**	Pole top rescue	• Safety of self and others • Identification between power, telephony, cable TV • Related precautions • Pole top rescue procedures
200	**OH251**	Working at heights	• Safety equipment and applications • Working practices and procedures
200	**OH260**	Manual handling	• Manual handling principles • Types of manual handling • Causes of injury • Guidelines for evaluating risk factors in manual handling • Discuss preventative and control measures that can be taken • Health problems associated with manual handling • Work layout and conditions affecting manual handling • Identify human factors that cause problems • Major factors causing manual handling injuries • Lifting actions to avoid • Planning for successful manual handling • Practical manual handling techniques • How to lift • Carrying a load • Setting down a load

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**PS210**	Building plan reading	• Street plans • Cable plans • Floor plans • Plumbing plans • Site layout drawings • Interpret drawing symbols
200	**PS211**	Cable support plan reading	• Component diagrams • Product assembly / connecting diagrams • Product fixing requirements
200	**PS212**	Read plans & specifications – general	• Cabling plans, records, symbols & abbreviations • Commercial premises plans • Backbone cabling diagram
200	**PS213**	Cable record systems – general	• Types of records • Cable distribution records • Jumpering records • Standard record systems • Responsibilities for records • Cable advice forms • ACA requirements
200	**PS214**	Plan reading, specifications & records – structured cable	• Related installation plans, cable layouts, outlet/frame locations, coding systems • Cabling Specifications • Test documentation • Compliance records
200	**PS215**	Plan reading, specifications & records – optical fibre cable	• Related installation plans, cable layouts, outlet/frame locations, coding systems • Cabling Specifications • Test documentation • Compliance records
200	**PS216**	Plan reading, specifications & records – co-axial cable	• Related installation plans, cable layouts, outlet / frame locations, coding systems • Cabling Specifications • Test documentation • Compliance records
200	**PS217**	Plan reading, specifications & records – underground	• Site, construction and building plans • Pipe and conduit diagrams • Termination diagrams • Record documentation
200	**PS218**	Plan reading, specifications & records – aerial	• Site, construction and building plans • Termination diagrams • Record documentation

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**PS220**	Basic building trades 2	Building construction types • Extensions, additions, removals • Safety and risk − Work platforms, 'cherry pickers' − Chemicals, asbestos, fire − Protective clothing • Access • Cable support methods − Route − Constraints − Concentration • Install fixings − Mark out − Specifications, strength, alignment − Tools and materials − Tensioned and supports, secured • Damage − Burrs − Sharp edges/angles
200	**RA210**	Radio frequency theory & hazards	Electromagnetic radiation hazards and safe working practices at radio sites. • The electromagnetic wave. • Differentiate between and state the health risks of ionising and non-ionising radiation. • Safe levels of exposure to electromagnetic radiation. • Safe working practices when working with or near radio transmitting equipment. • Hazard signs and need for barriers where safe levels may be exceeded.
200	**RE210**	ACA licensing standards, rules & regulations	• ACA role, Telecom. Act, legislative authority • Licensing types and limitations • Supervision requirements • ACA Technical Standards TS008, TS009 • Communications Cabling Manual • Mandatory and voluntary technical standards

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**RE215**	Legislative codes, practices & access requirements	• Building codes • Fire regulation • Noise abatement • Australian standards • National Trust / Heritage building codes • Local Council regulations • Site regulations • Industrial Reg. awards and conditions • Joint use code and agreement • Industry codes of practice • Road traffic control legislation, codes • Dial before you dig • Private ownership (access, reinstatements) • Forklift licenses, winch, crane • Utility providers • NATA, IEEE, EIA/TIA • TSB36/40, ISO11801 • Heavy vehicle licenses • Mining legislation • Confined spaces regulation
200	**RE216**	Australian standards & regulations	• AS/NZS 3080 • AS 3084 • Communications Cabling Manual
200	**RE220**	ACA standards & regulations – structured cable	• ACA compliance • UL certification • AS/NZS 3080, AS 3084 • Performance certification
200	**RE221**	ACA standards & regulations – optical fibre cable	• ACA compliance • AS/NZS 3080, AS 3084 • Performance certification
200	**RE222**	ACA standards & regulations – co-axial cable	• ACA compliance • AS/NZS 3080, AS 3084 • Performance certification
200	**RE223**	ACA standards & regulations – underground	• Utility providers: electricity, gas, water, telecommunications • Local councils • ACA compliance • AS/NZS 3080, AS 3084 • Performance certification
200	**RE224**	Building standards, regulations & codes – underground	• OHS codes • Environments protection • Road traffic control • Cabling security codes and regulations • Appropriate equipment licenses • Relevant legislation codes and regulations • Dial before you dig (location service)

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**RE225**	ACA standards & regulations – aerial	• Utility providers: electricity, gas, water, telecommunications • Local councils • ACA compliance • AS/NZS 3080, AS 3084 • Height above ground • Performance certification
200	**RE226**	Building standards & regulations – aerial	• OHS codes • Environments protection • Road traffic control • Cabling security codes and regulations • Appropriate equipment licenses • Relevant legislation codes and regulations • Dial before you dig (location service)
200	**RE235**	Regulations for CAN	• Work performed beyond the boundary of the customer premises ACA regulations for cable installation not enforced. Regulations for CAN personnel working exclusively on CAN are restricted to local and regional regulations and enterprise policy. • Enterprise specific requirements can be met with a selection of skill and knowledge sets from the RE200 series
200	**SU210**	Basic supervision	• Role of the Supervisor • Enterprise specific Organisational Chart • Effective communication
200	**SU221**	Cabling installation – estimating & quotations	• Base cabling licence coverage • Estimating cabling installation materials • Estimating time / labour costs • Use product brochures and price lists • Quotation requirements
200	**SU222**	Time management	• Time management principles • Time management methods • Work plans • Communication factors
200	**SU223**	Budgeting	• Principles of Budgeting • Budgeting calculations
200	**SU224**	Supervision of licensed cabling installations	• Base cabling licence (BCL) coverage • ACA: BCL responsibilities • Supervision requirements of non licensed workers • Types /levels of supervision • Allocation of work • Monitor work • Compliance of ACA rules, standards • Hazard identification and management • OHS responsibilities

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**SW210**	Basic switching systems	• Development of switching systems • Customer switching systems (CSS) • Simple block diagrams • Basic programming
200	**TE210**	Basic telephony 2	• Principles of sound • Transmission • Telephone transmitter • Telephone receiver • Telephone operation • Basic telephone circuits
200	**TO210**	Hand & power tools	• Typical telecommunications cabling hand tools • Typical telecommunications cabling power tools • Safe use and application to different mediums • Simple fabrication and assembly techniques • Soldering and de-soldering • Related safety practices, clothing
200	**TO211**	Hand & power tools & equipment – structured cable	• Specialised Cat 5 termination tools, equipment
200	**TO212**	Hand & power tools & equipment – optical fibre cable	• Specialised Optical fibre termination tools, equipment
200	**TO213**	Hand & power tools & equipment – co-axial cable	• Specialised Co-axial cable termination tools, equipment
200	**TO214**	Hand & power tools – underground	• Specialised tools, equipment for underground installations
200	**TO215**	Mechanical equipment operational skills – underground	• Excavation equipment: ditchwitch, backhoe, trenching machine, concrete cutter, borer • Back fill and landscaping equipment • Lifting
200	**TO216**	Cable hauling equipment operation skills – underground	• Spools, drums, feeders, slippers, hauling eyes, jinker, forklift, crane, winch
200	**TO217**	Hand power tools & equipment – aerial	• Specialised tools, equipment for aerial installations
200	**TO218**	Mechanical equipment operational skills – aerial	• Pole diggers and erector • Cherry picker • Scissor lifts
200	**TO219**	Cable hauling equipment operation skills – aerial	• Spools, drums, feeders, slippers, hauling eyes, jinker, forklift, crane, winch

LEVEL	CODE	TITLE	CONTENT GUIDELINE
200	**TO220**	Ladder handling	• Choosing the correct ladder • Erecting ladders • Extending ladders • Lowering extension ladders • Angle of slope for ladders • Securing the ladder to a pole • Ascending and descending ladders • Raising and lowering tools and materials • Working on extension ladders against poles • Working on stepladders

Group 3 Skills & Knowledge

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**AT310**	Acceptance Testing	This area is covered at relevant points in the Skills and Knowledge details for Network, Switching and Transmission.
300	**CA310**	Cabling Techniques 3	Specific cabling skills and knowledge required from the areas of: • Metallic • Optical • Structured • Coaxial • Underground • Aerial Details will include: • Tools • Cable types and cable codes • Termination • Jointing • Installation • Testing • Safe work practices • Hauling • Specifications, Standards and Regulations See the CA200 to CA296 series for specific details in the required area/s
300	**CA315**	Cabling Techniques For CAN	Specific CAN cabling skills and knowledge required from the areas of: • Metallic • Optical • Structured • Coaxial • Underground • Aerial Details will include: • Tools • Cable types and cable codes • Termination • Jointing • Installation • Testing • Safe work practices • Hauling • Specifications, Standards and Regulations See the CA200 to CA296 series for specific details in the required area/s

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**CA320**	Optical Techniques 3	Light wave propagation in optical fibres. • Velocity of propagation in a material. • Refraction and refractive index. • Angles of incidence and reflection, critical angle, • Total internal reflection. Snell's Law. • Numerical aperture, cone of acceptance, coupling • Efficiency. • Single mode and multimode propagation. • Step index and graded index. • Advantages and disadvantages of the common mode/index types. • Common core cladding and buffer diameters. • Optical fibre construction methods. Major characteristics of the fibre optic media • Main characteristics of optical fibres. • The types of losses in optical fibres • Light emitting diodes • Laser diodes • Photodiodes (pin and apd) • Coupling efficiency of light source vs light detector. • Coupling efficiency of led vs ld. • Modal equilibrium of multimode fibres. Key subunits of a digital optical system • Transmitter and receiver subunits and functions. • Operating wavelengths, losses and regeneration limits. • Industrial visit of a commercial site which uses smof in the transmission of digital data. Basic fibre optic system measurements • Measurement of optical power level and power loss. • Bit error rate tests of a fibre optic system. • Measurements using an otdr. • Construction of an equilibrated reference cable.
300	**CA325**	Cable Jointing & Termination For CAN	• Copper cable jointing • Cable termination products − Structured cable − Co-axial cable − Optical fibre cable
300	**CA340**	Cable Systems And Products	Specific cabling skills and knowledge required from the areas of: • Plan reading • Cable record systems • Legislative Codes, Practices and Access requirements • Cabling products • System tests See the CA200 to CA296 series for specific details in the required area/s

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**CA360**	Co-axial Cabling	Specific cabling skills and knowledge required from the areas of: • Installation methods and termination • Products • Testing See the CA200 to CA296 series for specific details in the required area/s
300	**CA370**	Cable Installation Practices	Covered in CA310 Cabling Techniques 3
300	**CA375**	Cable Installation Practices For CAN	Covered in CA315 Cabling Techniques for CAN
300	**CA380**	Pressurised Cabling For CAN	• Installing contactor alarms • Installing air seals and bypass valves • Installing test points • Localise sheath faults • Repair lead and moisture barrier sheath cables • Localise leaks with helium gas • Perform maintenance procedures
300	**CI310**	Communication 3	Communication • How communication takes place • Appropriate communication channel • Barriers to communication • Interpret and comprehend information • Non-discriminatory language Listen • Active listening skills • Bad listening habits. Write • Clear, concise written communication with attention to use of words, sentences, grammar and expression. • Different forms of short business communication including memos, letters, facsimiles and e-mail • Basic reports • Work reviews, including, assessing length of sentences and considering audience needs. Speak • Before speaking • With a pleasant, effective speaking style • To audience needs • Appropriate social and business introductions.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**CO310**	Computer Skills 3	• Basic features, facilities, fundamental hardware and the basic operational procedures of a typical PC. • Keyboard operation using typing techniques and practiced manual skills. • Use terminology associated with word processing and file management. • Access the Internet to retrieve information and use e-mail for communication. • Access an established database file, use appropriate software functions to search, sort and select data. − Apply skills to meet the requirements of a given situation e.g. To manage spare parts: check stock, usage, ordering, surplus, audit of stock. − Locate and access parts and display, look for alternate parts, check for compatibility and if latest issue. − Recover faulty part, send for repair and update database. • Create simple databases to keep records of repair/replace details of Telecommunication "equipment", details of action taken, record part used/obtain or order appropriate parts. • Produce useable reports from a database file according to specified criteria. • Install software for a given application of Telecommunication equipment, configure the software and hardware according to installation documentation. • Run test programs to verify proper operation.
300	**CS310**	Customer Relations 3	Dealing with Customers and Clients • Needs of the customer/client • Communication that are consistent with customer needs • Information regarding facilities, services and products to customers and clients • Service customers according to workplace standards and organisation policy • Use telephones effectively to interact with clients. • Deal appropriately with a difficult situation involving a dissatisfied customer. • Keep accurate customer records using the appropriate organisation documentation.
300	**CS320**	Customer Training 3	• Demonstration skills • Client interaction • Documentation • Contractual requirements • Product specification and performance

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**DI310**	Digital 3	*Assumed – TO320 Antistatic Procedures 3* • Main functional units which make up telecommunication equipment such as a modem, and how it connects to a parent network. • Need for interfacing, data transfer, control and timing circuits, and the role of handshaking (protocols) procedures as applied to telecommunication equipment. • International standards for interface and connection of communications equipment. • Principles and methods of encoding data, and error detection. • Range of measurements and tests to ensure the correct and efficient operation of telecommunication equipment and customise as required. • Faults in both software and hardware and suggest remedies for common malfunctions. • Safety principles when handling electronic equipment in relation to personal safety and ESD protection for electronic devices and pc boards.
300	**EL310**	AC/DC Theory 3	DC Theory • The role of power supplies within a telecommunications installation. • Circuits of basic telecommunications power supplies. • The terms regulation and filtering. • Calculate required components to effectively regulate and filter a rectified power supply, given necessary parameters. • Advantages and disadvantages of following sources and common techniques used to mitigate against the disadvantages when used: − Cells − Batteries − Solar panels − Motor/generator or standby sets. • Cathodic and anodic reactions for cells in common use within the telecommunications industry. • Purpose of protective electrodes and processes leading to the attrition of protective electrodes. (e.g. sacrificial anodes, galvanising of steel, methods used to protect aluminium) AC Theory • Operation of transformers, rectifiers and purpose of rectification within telecommunications power supplies. • Principles of operation of switched mode power supplies. Types of uninterruptible power supplies used within the telecommunications industry, giving advantages and disadvantages of each, together with the likely location or usage of each type.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**EL320**	Earthing 3	• Principles of earthing and earthing systems within telecommunications systems and installations. • Reasons for earthing within telecommunications systems and installations. • Types of earths: − Protection − Signal − Power. • Earth cabling and relevant standards applicable to earthing within telecommunications installations. • Equipment and situations requiring earthing and methods of earthing. • Differences between grounding and bonding. • Methods and equipment used for surge diversion. • Electrodes and materials used in earthing systems. • Implement methods of installation of an earth system within a telecommunications facility. • Processes which after time, can compromise an earthing system. **Note:** All practical work must be carried out in compliance with the relevant legislation where applicable.
300	**EL330**	Power Installation	*Assumed EL310 AC/DC Theory 3* • Principles of operation and testing method of rectifier diodes. • Operating parameters for single phase and rectification. • Filter circuits. • Basic regulators. • Faults in typical power supply circuits
300	**EN310**	Enterprise Policy & Practice	• Policy and practice implications for competency related outcomes.
300	**EN320**	Enterprise Information Systems 3	• Information systems related directly to recording competency unit outcomes.
300	**ET310**	Electronics Principles 3	• Basic electrical principles and concepts in relation to current flow from various sources of emf for various applications. • Calculate and perform measurements on resistive and reactive circuits connected to AC and DC supplies, including cells in series and parallel, and solar cells. − Processes of converting AC power to DC and identify various types of rectifier circuits.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
			• Charging of various types of chemical cells and batteries. − Correct and safe charging procedures, handling and storage of cells and batteries. − Battery discharge and tests to determine suitable cell (including solar cells) or battery for specific applications. • Measurements and tests by reading a circuit diagram to check for electrical safety, compliance to specifications and requirements. • Faults on power equipment, distribution panels, cables, batteries and rectifiers. • Causes of malfunctions in electrical and electronic installation/equipment including environmental hazards, human and manufacturing processes. • Methods of protecting electrical/electronic installations with reference to screening, over voltage, surges and spikes, lightning conductors, MEN (Multiple Earth Neutral) and equipment potential bonding. − Potential earthing locations for cable routes, cable trays, data cabinets, equipment enclosures, cross connects, distributors (MDF, IDF, FDP).
300	**IN310**	Interpersonal relationships 3	Create a positive communication climate • interact in a supportive way • use assertive communication • construct "I" statements • use different types of feedback appropriately • give accurate, clear and comprehensive instructions • prepare different types of questions • follow a set of instructions Develop non-verbal skills • analyse non-verbal communication • use body language to communicate • promote a prompt, positive, professional image • send corporate messages • recognise cultural differences and avoid gender bias
300	**IN320**	Teamwork 3	Work-team communication • participate in a small group discussion to reach agreement on a workplace-related issue • cooperate with team members to plan and prepare a simple job related presentation • make the presentations

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**IN330**	Negotiation 3	Effective negotiation skills • plan for a negotiation • analyse various negotiating options − compromise − collaboration − competition − accommodation − withdrawal/avoidance • use negotiation for problem solving • obtain meaningful concessions
300	**MA310**	Basic Mathematics 3	• Arithmetic functions – with and without a calculator • Fraction arithmetic • Metric units • Scientific and Engineering notation • Estimates – length, volume, area • Indices • Geometry – sketches, plans • Solve equations with a single variable
300	**MA320**	Mathematics 3	• Use charts, graphs and tables to analyse data • Use paper and electronic spreadsheets to record information • Estimate and measure lengths, volumes and area
300	**MO310**	Mobile Phone Product Knowledge	Knowledge of features and facilities • Physical features • Data compatibility • Battery features and types • Memory − Capacity − Store and recall functions • Accessory range • Network facilities − Call waiting, call diversion Operation • Call / recall / end call • Memory − Store and recall functions − Battery operation
300	**MO320**	Mobile Phone Operation – Basic	• Basic components • Installation location • Mounting • Control Unit installation • Cable Installation − Cable routing − Power cable − Control Unit cable − Antenna cable

LEVEL	CODE	TITLE	CONTENT GUIDELINE
			• Antennas − Selection − Location • Hands Free equipment • Testing • Customer Education
300	**MO330**	Fault Finding For mobile Phones	• Common faults − Network − Vehicle specific − User operation − Mobile equipment − Phone and accessories • Fault Identification − Customer consultation − Operation tests − Fault isolation − Confirmation of fault • Customer Service considerations • Detailed Fault Analysis − Test equipment − Testing methods − Diagnosis of test results • Fault rectification • Repair or replacement of fault
300	**MO340**	Mobile Phone System Operation And Programming	Content will be vendor specific
300	**NE310**	Network Equipment 3	• Typical telecommunications networks and associated basic equipment elements and their characteristics: • Public Switched Telephone Network (PSTN) • Private Automatic Branch Exchange (PABX) • Television Distribution • Pay TV • Public Land Mobile Network (PLMN) − Global System for Mobile communications (GSM) • Packet switched data networks − X.25 − Frame Relay − Asynchronous Transfer Mode (ATM) − Internet • Shared access data networks − Ethernet − Token Bus − Token Ring • Dedicated data network • Digital Data Network (DDN) • Packet/dedicated data network • Integrated Services Digital Network (ISDN)

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**NE320**	Network Architecture 3	Telecommunications network architecture. • Network as a pattern or arrangement of intersecting lines. • Traditional networks are service specific - telephony or data or video. • Networks are becoming more integrated to ultimately combine telephony and data and video over one network. • The two categories of networks, public and private. Public Switched Telephone Network (PSTN). • Basic elements that interconnect to form a hierarchical PSTN. Private Automatic Branch Exchange (PABX). • Basic elements that interconnect to form a PABX network . Television distribution network. • Basic element interconnecting to form a TV distribution network via terrestrial and satellite. Pay TV distribution network. • The basic elements that interconnect to form a Pay TV distribution hybrid fibre-cable (HFC) network. Global System for Mobile communications (GSM). • Basic elements that interconnect to form a GSM network. Packet switched data networks. • Basic elements that interconnect to form a Packet Switched Public Data Network (PSPDN). Shared access data networks. • Basic elements that interconnect to form shared access data networks in LANs using the following topologies, − Point to point − Point to multipoint (mesh) − Multipoint (bus and tree) − Star − Ring − Dual ring Dedicated data network. • Basic elements that interconnect to form a Digital Data Network (DDN).

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**OH310**	Occupational Health And Safety 3	• Appropriate tools for the task. • Correct use of hand tools and operation of power tools in order to reduce the risk of injury. • Causes of injuries due to incorrect work practice ranging from personal behaviour to site conditions, materials, machinery and equipment malfunction. • Appropriate steps to follow in case of fire. • Correct fire extinguishers for the class of fire and demonstrate its use effectively. • Methods of rescuing a person who may be in contact with live electrical conductors or equipment and apply basic first aid procedures. • Hazards, select and use appropriate protective clothing and other personal safety equipment for protection to self, fellow workers and the public at large.
300	**OH320**	Safe Handling	• Appropriate ladders, scaffolding, hoists, harness and fastening to access the structures. − On-site tests to determine the hazard level of radiation from telecommunication equipment, and take preventative action to minimise risk. • Manufacturer's specifications for securing, load capacity, and installation of superstructures and structural equipment. • Manufacturer's instructions for handling of batteries, hazardous gases, materials and chemicals, in relation to their transport, storage, use and first-aid procedures. − Materials which cause chronic illnesses with long term exposure including asbestos, radiation and measures to prevent such substances being absorbed into the body.
300	**PE310**	Personal Skills 3	Self Discipline • Learn − Training pathways and career opportunities in telecommunications industry − Principles and philosophy of adult learning − Learning contract and its applications • Read − Main components of the reading process − The 4s reading technique − Reading speed and efficiency − Comprehension and recall − Vocabulary extension • Study − Achieve study goals − Study programs − Need for a good study environment − Exams

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**PE320**	Remote Work	Maintain personal well being and safety • Physical and psychological status • First aid training • Outdoor survival skills • Navigational skills • Driving ability for the terrain and environmental conditions to be encountered • Transport, food, accommodation communication and social support • Time management techniques • Stress management techniques • Communicate personal routine to others regularly • Use emergency communication if necessary Perform professional duties • Checklists for all material and equipment to be supplied • Secure transit of material equipment • Contingency plan for delays and obstacles encountered due to distance and environmental factors. • Communicate to give and receive feedback from clients, enterprise and relevant authorities
300	**PK310**	Product Knowledge 3	• Functions of specific products related to competency unit.
300	**PR310**	Problem Solving 3	• Differentiating between symptoms and problems • Planning versus intuition • Analysis of data and planning decisions • Devise plans, implementation of action • Review actions and effectiveness • Implement alternatives if necessary

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**PS310**	Plans & Specifications 3	• Types of Plans − Floor − Building − Reflected ceiling − Schematic drawings • Standard symbols − Plumbing − Structures − Electrical − Cables − Circuits • Dimensions and Measurements − Installation − Instructions − Specifications − Location − Orientation • Interpret manuals − Equipment − System − Enterprise policy − Documents and regulations
300	**PS320**	Basic Building Trades 3	Covered in PS220 Basic Building Trades 2
300	**RA310**	Radio Frequency Theory And Hazards 3	*Assumed RA210 Radio Frequency Theory and Hazards* Electromagnetic radiation hazards and safe working practices at radio sites. • The electromagnetic wave. • Health risks of ionising and non-ionising radiation. • Safe levels of exposure to electromagnetic radiation. • Safe working practices when working with or near radio transmitting equipment. • Hazard signs and barriers where safe levels may be exceeded. Applications of radio communication in systems telecommunications networks. • Diagrams of a basic radio communication system. − **Terms:** 'Terrestrial', 'simplex', 'half-duplex', 'full-duplex'. • Types of radio systems found in telecommunications networks. Requirements for modulation. • Base band. • Typical base band signals in both time and frequency domains. • Frequency bands found in the radio frequency spectrum. • Bands used for telecommunications and commercial radio systems.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• The relationship between base band signal and bandwidth. • Need for modulation in radio transmission systems. Noise on a radio transmission system. • 'Signal-to-noise' ratio. • Noise types found in radio systems. • Effects of noise on a radio transmission system. • Methods of overcoming the effects of noise in a radio system. Microwave radio communication systems. • Frequency bands used. − **'Terms:** 'drop and insert', 'unprotected', 'cold standby', 'hot stand by', 'twin-path', 'N+1'. • Block diagrams of microwave radio relay systems incorporating the above terms. • Antenna requirements for a microwave radio system. Satellite radio communication systems. • Frequency bands used. • Communications satellite and satellite communication system. − **Terms:** 'uplink', 'downlink', 'transponders', 'footprint', 'earth station' Cellular phone communication systems. • Frequency bands used. • Benefits of cellular radio. − **Terms** - 'cell', 'cell splitting', 'frequency re-use'. • Basic block diagram of a cellular phone interconnection with the PSTN.
300	**RC310**	Riggers Certificate 3	Refer to the relevant state authority for the type of qualification and training required. If a recognised licence or certificate is not required refer to TC310 and TC510.
300	**RE310**	Working On Non-Enterprise Land 3	• Enterprise policy • Local regulatory authorities • OH & S requirements • Enterprise Liability See also RE215 Legislative codes, practices and access requirements.
300	**RE320**	Employment Regulations	• Federal/State legislation including EO, OHS and Work cover • Safe work practices • National, State and Local Council regulations and by-laws • Employer and Union organisations • Relevant Awards and agreements • Employment Law.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**RE330**	Contract Law	• Contract Law • Law of Property and Mortgages • Law of Tort • Essential features of a contract • Letters and diaries • Relationship between various contracts, estimates, tenders and related documents • Specialty contracts − Leases − Franchises − Hire purchase − Insurance
300	**RE340**	Regulations For CPE	• ACA Customer Premises Cabling • ACA Technical Standards • Australian building codes and regulations • Fire regulations • OHS • Trade Practices legislation • Confined spaces regulations
300	**SP310**	Spare Parts 3	• Enterprise policy and procedures • Stock levels – monitoring and replacement • Sourcing replacement parts • Transport of parts • Recording and reporting
300	**SU310**	Basic Planning 3	• Organise resources and time • Set objectives • Safe work practices
300	**SU320**	Leadership 3	• Role of the Supervisor • Situational leadership • Communication Skills • Motivation • Power and influence • Delegation • Enterprise specific organisational chart
300	**SU330**	Quality Procedures 3	• Quality concepts • Quality Management Systems – Australian standards and International standards • Reading quality system documentation • Preparation for quality auditing

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**SW310**	Switching Products 3	Switching Function in Telecommunications Networks • Analogue and digital communications. • Switching and transmission. • Functional blocks of a switching system. • Private and public networks. Categories of Switching Systems • Voice and data switching. • Analogue and digital switching. • Circuit switching and packet switching. Switching Elements of PSTN • Functions of local exchange, transient exchange and international gateway. • Functions of remote subscriber units and remote integrated multiplexers. Architecture of PSTN Switching Elements • Differences in architecture of local and transit exchanges. • Main sub units of PSTN switching systems. • Architecture of analogue and digital PSTN exchanges. Features Offered by PSTN • Common subscriber features offered by the PSTN. Private Voice Switching Systems • Role of PABX in a telecommunications network. • Functions of PABXs and PABX networks. • PAB, Centrex and VPN. • Architecture of PABXs. • Common user features of PABX. • Data switching via a PABX. • Digital voice interface on a PABX. • ISDN PRA interface from PABX to PSTN. • Functions of operator in PABX. Characteristics of Packet Switches • Operation of a virtual circuit packet switch. • Operation of a data gram service packet switch. • Common user features offered by packet switches. • Functions of PAD concentrators and modems. Band Width Switching • Functions of a digital cross connect switch. Switching System Administration • Input / output facilities on switching systems, including interface for PC's, printers, disc and tape drives, remote operations access.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TC310**	Tower Climbing 3	Fixed Gantries and Ladders • Climb fixed ladders and gantry using appropriate safety equipment • Safety of site against falling objects • Appropriate notifications are made to site supervisor before gaining permission to tower climb • Appropriate emergency procedures for communication of problem before attempting climb • Maintenance and safety check on all equipment before climb including hard hats, safety boots, safety harness (for resting and emergency rescue) and fixed and or removable ladders/gantries • Safety of ascent and descent of a fixed ladder using a resting harness to at least 10m height Movable Ladders and "Cherry Pickers" • Ensure operator has current certificate for this equipment from the appropriate licensing authority. • Dangers associated with live electrical wires and obtain clearance from power authorities before climbing in a danger area • Portable ground ladders and safe angles of pole according to Australian Standards • Ensure extension ladders and "cherry pickers" are not used beyond extension limits. • Correct use of mobile "cherry picker" and extension ladders to climb poles of at least 10m
300	**TE310**	Basic Telephony 3	Major Telephony System Components • The three categories of information signals which can be carried in a telecommunications system. • Four main roles for an electronic telecommunications system. • Block diagram of a basic voice telephone communications system consisting of handsets, switches, transmission media. Specific System Components • Block diagram of a basic data communications system consisting of DTE's, MUX's, DEMUX's, transmission media. • Terms: − Local loop − Local switch (co) − Tandem (toll) switch − Transmitter − Receiver − Modulator − Demodulator − DTE − CPE − MUX/DEMUX.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Specialised Telephony Systems • Block diagram of a satellite communications system showing the major functional sections, and describe the basic operation of the satellite communication system • Simplified block diagram of a mobile telephone system showing the major functional sections, and describe the basic operation of the mobile telephone system. Functions Telephony System Technology • Terms as applied to a telecommunications system. − 'Transmission' − 'Switching' • Types of transmission media used for information transfer. • Characteristics of each transmission medium and the type of medium which may be used by each form of information transmission.
300	**TF310**	Test Equipment 3	Electronic test equipment (basic). • Analogue multimeter (AMM). − typical measurements that can be performed using an AMM. • Digital Multimeter (DMM) − Terms relating to a DMM - ‘accuracy’, ‘resolution’, ‘sensitivity’ • Cathode Ray Oscilloscope (CRO). − Main advantages of using a scope compared to a voltmeter. − Measure amplitude, frequency, and phase difference on a scope. − Typical parameters of an analogue scope. • Function generator. − Typical uses for function generators in electronics. − Output waveforms available from a function generator including the use of symmetry control. − Typical output parameters: Impedance, Voltage, Frequency, Duty cycle. • LCR meter. − Measurements that can be performed using a LCR meter. • Millivoltmeter (or dB meter). − Applications for millivoltmeters. − Circuit output levels - Volts/millivolts, dBs, dBm’s. Digital test equipment (basic). • Logic pulsers. − Applications of logic pulsers in digital circuits. • Logic probes. • Applications of logic probes in digital circuits.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Telecommunications test equipment (basic). • Cable locators and pair tracers/identifiers. − Use of cable locators − Applications of pair tracers. • Transmission measuring set (TMS). − Applications of a TMS. − Output levels measured as a voltage or a power level. − Bridging and terminated measurements with a TMS. • Buttinski. − Applications and features of buttinskis. • Visible laser fault finder. − Applications: Breaks, Bends, Stress in optical fibre patch cables with a visible laser fault finder. • Cable scanner. − Applications of cable scanners in LANs. − Typical tests that can be performed by a cable scanner.
300	**TF320**	Test Analysis And Diagnosis 3	Test analysis basics. • The goal of test analysis - rapid equipment/system restoration. • A logical systematic approach to test analysis is required. Three phases of fault diagnosis. • The three phases required to diagnose any electronic equipment fault − Performance evaluation. − Repairing the device. − Performance re-evaluation. Performance evaluation. • Determine if there is a fault. • Recognise any symptoms. • Use theory knowledge to isolate fault to faulty section. • Use block diagrams and/or schematics to trace signal path. • Isolate the fault to a sub-unit by elimination of the sub-units which are functioning correctly. Repairing the device. • Replace the faulty card or component and realign if necessary. Performance re-evaluation. • Perform stringent testing of device to confirm specification functionality
300	**TF330**	Fault Finding 3	Responsibility for fault repairs. • Organisation manage their own telecommunications system and have to fix the faults or contract someone to do it. • If the carrier manages the network it is their problem when they know about it.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Demarcation problems at the user/carrier interface and at the interfaces between carriers. The telecommunications carrier fault finding process. • Steps in the fault finding process: − User identifies the fault. − User reports the fault. − Technicians find the fault. − Technician repairs the fault. − User is informed that the service is now available. Fault finding techniques. • Progressively swap suspect parts until the fault has been cleared. • The half split method of fault finding. • Compare measurements of a faulty unit to that of a known working model. • Compare measurements of faulty unit/system to measurements taken when unit/system was commissioned. • Establish 'the main' signal path through the equipment using a block diagram or schematic and then test the signal path. • Manufacturer supplied fault finding flow chart. • Fault finding flow chart prepared by the technician.
300	**TF340**	Testing Principles 3	Testing or service centre. • Safety requirements of a typical service workshop. • Physical requirements of a typical service workshop. • Trained technicians using appropriate test equipment. Functional testing. • Connect up a variety of test equipment, turn on and then analyse performance. Use of appropriate test equipment. • Test equipment used to − Measure DC voltages. − Measure AC voltages from audio up to 20 mhz. − Measure AC voltages greater than 20 mhz. − Test simple digital circuits. − Test complex digital circuits. Limitations of test equipment. • Meter loading effects of AMMs and DMMs for DC voltage measurements especially in high resistance/impedance circuits. • Loading effects of cathode ray oscilloscopes with and without 10:1 probes. • Advantages of using of using a digital scope when measuring a single event or non-repetitive wave.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TO310**	Use Of Tools 3	Basic hand tools: • Spanners (open end, ring and shifters) • Wrenches (vice grips, multi grips, stillsons, torque) • Allen keys • Screwdrivers (flat, phillips, posidrive) • Sockets and accessories • Hammers (claw, ball pein and technicians) • Hand rivet guns • Rulers • Tape measures • Squares • Hand drills • Chisels (wood and metal) • Files (hand flat, round, half round, square, triangular) • Knives (pocket, stanley) • Scissors • Tin snips and shears • Bolt cutters • Nibblers • Saws (various hacksaws and blades, various wood saws) Safety with hand tools. • Safety requirements when using hand tools including: − Select correct tool and size of tool for job. − Check condition of tool before using. − Do not use worn or damaged tools. − Maintain tools in good condition − Use tools in correct manner. − Store and carry tools safely. • Applications of basic hand tools. • Typical applications of general hand tools listed. • Correct procedures for using general hand tools listed.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TO320**	Anti-Static Procedures 3	Generation of static electricity. • How static electricity is generated. • How humidity affects the generation of static electricity. • Causes of static electricity in the electronic workplace. • Causes of static electricity generation and typical voltages that can be generated including: − Walking across carpet - 35,000 volts, Walking over vinyl floor - 12,000 volts, Working at bench - 6,000 volts, Opening plastic envelopes - 7,000 volts, Sitting at work chair - 18,000 volts • Susceptibility of common semiconductor devices to static electricity damage. • Electronic devices which can be easily damaged by static electricity and their typical minimum susceptibility voltage levels including: − VMOS - 20 volts − GaAsFET - 20 volts − SOS - 20 volts − MOSFET - 100 volts − EPROM - 100 volts − JFET- 150 volts − OP-AMP - 200 volts − CMOS - 200 volts • Damage may be immediate or partial, so the device may pass manufacturer's tests but fail in the field later. Specialised tools and handling techniques for static sensitive devices. • Tools developed for the electronics industry to minimise risk of static electricity damage to electronic devices including: − Wrist straps, Table and floor mats, Heel grounders, Anti-static garments, Shielding bags, Conductive foams and films, Conductive containers, Service kits, Earthed soldering irons, Anti-static sprays, Air ionising devices, Static safe chairs, Conductive gloves, Static testing devices. • Techniques used to minimise risk of damage to static sensitive electronic devices, other than using specialised tools listed: − Minimise handling, do not overheat device when soldering, connect all test instruments, earthing mats and equipment under test to a common earth, do not insert devices or cards with power on, use approved packaging labels which indicate correct handling required, keep workstations free of plastic, Styrofoam and cellophane, follow an electrostatic control program.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TO330**	Installation Practices 3	Safety in telecommunications. • Correct lifting procedure. − Position feet correctly − Obtain a proper hold − Maintain a straight back • Correct lifting techniques • Ladder types used in telecommunications: − Step − Extension − Insulated. − Correct ladder selection. − Correct ladder lifting and placement techniques. Mechanical fitting skills in telecommunications. • Correct technique to install: − Two lengths of unistrut across a room. − And join lengths of cable trays. − Cable tray on the unistrut. − And brace a 19 inch rack. − A catenary wire across a room. − Optical fibre channelling.
300	**TO340**	Basic Ironwork 3	Sheet metal types. • Types of sheet metals used in the telecommunications industry including: − Standard − Perforated − Colour bond − Stainless steel − Zinc coated − Aluminium • Applications for each of the sheet metals listed. • Identification of each of the listed sheet metals from a sample. Personal protective clothing and equipment. • Personal protective clothing and equipment requirements when fabricating sheet metal including: − Wear close fitting clothing which is buttoned − Don't wear torn clothes, ties or loose belts. − Wear suitable footwear which covers the toes (safety shoes/boots preferred) − Keep long hair under caps or nets − Wear safety glasses, goggles or face shields as required. − Wear stout gloves when handling hot or sharp materials.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Care in the use of machinery. • Personal safety requirements when using machinery with moving parts including: − Never use unfamiliar equipment unless you have been instructed in its correct use. − Keep fingers away from moving parts. − Always use guards supplied with machinery. − Concentrate on the job you are doing. Fabrication of sheet metal. • Correct procedure for accurately measuring and marking out using: − Steel rules − Callipers − Squares − Scribers/dividers • Appropriate tools and sheet metals, correctly perform the following tasks to within prescribed dimensions when: − Cutting using a guillotine − Bending using a bender − Drilling using a drill press − Punching using a turret punch − Notching using a hand notcher.
300	**TO350**	Cutting And Drilling 3	Power tools used for cutting and drilling. • Power tools used for cutting and drilling including: − Drills (cordless, mains/portable, pedestal/variable speed, hammer, reversing) − Drill bits (twist, de-burring, spade, masonry, hole saw) − Jigsaws − Nibblers − Grinders (angle/pedestal) − Circular saw (various cutting blades) − Guillotine (floor standing) Personal protective clothing and equipment. • Protective clothing and equipment requirements when cutting or drilling including: − Wear close fitting clothing which is buttoned. − Don't wear torn clothes, ties or loose belts − Wear suitable footwear which covers the toes (safety shoes/boots preferred) − Keep long hair under caps or nets − Wear safety glasses, goggles or face shields as required − Wear stout gloves when hot, sharp or corrosive materials are being handled − Wear appropriate aprons in special circumstances.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Electrical safety with power tools. • Electrical safety requirements when working with portable mains powered power tools: − Ensure earth connection is intact if tool is meant to be earthed − Use earth leakage circuit breaker (safety switch) for additional protection − Do not earth double insulated tools − Do not use power tools in wet environments. Care in the use of machinery. • Personal safety requirements when using machinery with moving parts including: − Never use unfamiliar equipment unless you have been instructed in its correct use − Keep fingers away from moving parts − Always use guards supplied with machinery − Concentrate on the job you are doing. Applications of power cutting and drilling tools. • Typical applications of cutting and drilling power tools listed. • Correct procedures for using cutting and drilling power tools listed.
300	**TR310**	Basic Transmission Theory 3	History of telecommunications transmission systems. • Transmission mediums available: − Open-wire − Twisted pair − Co-axial cable − Wave guide − Radio − Optical fibre. • Current transmission medium systems: • Principles of FDM. • Problems with increasing capacity of inter-exchange junction cables in 1960s and 1970s. Comparison between analogue and digital transmission systems. • Disadvantages of analogue transmission systems in terms of, noise, distortion, attenuation and capacity. • Problems with analogue transmission as distances increase. • Advantages of digital transmission systems in terms of, noise, distortion, attenuation and capacity. • Advantages of digital transmission as distances increase. • Cost, reliability and bandwidth factors of analogue and digital transmission systems. • Analogue transmission systems can also carry digital information.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• How digital transmission systems can also carry analogue information. • Block diagram models of analogue and digital communications systems. • Integration of voice, data and image over one transmission network. • Integration of digital switching and digital transmission in telecommunications.
300	**TR320**	Modulation Theory 3	Analogue Modulation. • Space division multiplexing (SDM). • The need for modulation, in terms of FDM and conversion to a frequency suitable for the transmission medium. • Basic principles of AM and FM. • Advantages of FM compared to AM. Pulse Modulation. • Basic principles of PAM, PWM and PPM. Digital Modulation. • Pulse Code Modulation (PCM) • The encoding process: − Sampling. − Quantising. − Encoding. • Nyquist theorem. • Sampling rate for voice telephony. • Word size and data rate for digitised telephone voice channels. • Terms: − Quantisation error − Quantisation noise. • Companding: − A Law − μ Law. • Minimum bandwidth requirements for 64 kbit/second as half bit rate. • Block diagram of a CODEC. • Test a PCM encoder/decoder at various audio levels and frequencies.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TR330**	Time Division Multiplexing 3	Time Division Multiplexing (TDM) Basics. • Basic principle of TDM • Need for synchronisation in TDM. • Sketch a 3 channel mux-demux TDM system. PCM 30 System. • PCM 30 system. • Calculate the bit rate for the E1 channel. • Frame plan for PCM 30 showing synchronisation and signalling channels. • Synchronisation requirements and the bit stuffing technique in PCM 30. Plesiochronous Digital Hierarchy (PDH). • Explain the term PDH. • All local clocks in PDH are free running. • Hierarchy structure in PDH from E1-E5, including bit rate and equivalent number of voice channels. PCM 30 System Evaluation. • Test a PCM 30 system and compare audio distortion levels after mux-demux with input.
300	**TR340**	Transmission Technologies & Products 3	Transmission Technologies • Information sources sent over a transmission network: − Voice (telephone/cellular phone to telephone/ cellular phone) − Image (studio to studio) − Music (studio to transmitter) − Data (computer to computer via lan/man/wan) − Facsimile (fax to fax). • Common transmission mediums used to carry information over a network: − Twisted pair − Co-axial cable − Radio (terrestrial/satellite) − Optical fibre. • Typical information transfer rates for the common transmission mediums. • The terms bearer and channel. Repeaters In Transmission Networks. • The term repeater or regenerator in a transmission network. • Need for repeaters in various transmission networks. • Basic operation of a repeater. • Block diagrams depicting typical distances between repeaters in commonly used transmission networks. • Drop/insert (add/drop) used in repeaters. • Hardware requirements to access 1x 64 kBit/second channel from an E4 or E5 bearer.
		(continued from previous page)	Multiplexer Test. • Connect a DSO to a monitor access point and capture a trace and compare to pulse mask.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TR350**	Transmission Software	Multiplexer Configurations. • Possible inputs for an E1 multiplexer: − Analogue voice − 2 wire subscriber end (fxs) − 2 wire exchange end (fxo) − 4 wire e & m signalling − Data − 9,600 bits/second − 19,200 bits/second − 64 kbits /second − 128 kbits/second − 256 kbits/second. • Typical alarms provided on an E1 mux – demux including: − 2 Mbits/second input signal missing − Frame alignment lost − Received signal is AIS − Above BER threshold − Far-end alarm received − Synchronisation loss Programming a Multiplexer. • Methods of programming an E1 mux - demux, − Service or control terminal − Pc via a maintenance interface − From network management centre via a separate data channel (service channel). • Software settings on E1 mux – demux including: − Clock sources − Ais enabled − Ber alarm levels − Service channel enable − Line coding Testing a Multiplexer. • Software loops that can be programmed for testing purposes: − Main − Tributaries − Loop to equipment − Loop to facility • Test an E1 mux - demux system with a remote software loop-back and perform a BER − Test on one data channel.
300	**TV310**	Pay TV Product Knowledge	Enterprise specific knowledge to be obtained through enterprise training. • Pricing • Packaging of customer services and enterprise products

LEVEL	CODE	TITLE	CONTENT GUIDELINE
300	**TV320**	Pay TV Installation & Tuning Principles	• Site assessment − Unit location − Cable route − Customer approval • Cable Techniques aerial or underground • Network Termination device installation • Wall plate installation • Cabling set top unit − Manufacturer manuals • Tuning methods − Verification of unit operation − Maintenance of customer existing services • Reading and interpreting manufacturer manuals • Customer education − Pay TV Operation − Recording programs − Free-to-air services
300	**TV330**	Fault Finding & Rectification For Pay TV	*Assumed TV320 Pay TV Installation & Tuning Principles* • Common faults • CPE − Cable • Set Top Unit (STU) − Network • Causes of faults • Fault: − Isolation methods − Identification − Repair • CPE – Customer advice − Cable – repair or replace • STU – Analyse in context of unit type and repair or replace − Network – enterprise procedures

Group 4 Skills & Knowledge

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**CA410**	Optical Techniques 4	• Covered in CA310 Optical Techniques

400	**CI410**	Communication 4	Write
			• Advantages of using plan English in the workplace.
			• Writing strategies using plain English to deliver good and bad news, to inform and persuade.
			• Edit according to the principles of plain English.
			  • Graphical Communication
			• Interpret graphics in the workplace documents including
			  − Graphs
			  − Charts
			  − Tables
			  − Maps
			  − Photographs
			  − Clip art
			Communicate to secure a Job
			• Investigate employment opportunities
			• Evaluate self
			• Prepare a professional resume
			• Write a letter of application
			• Make a telephone application
			• Perform effectively in a job interview.

400	**CI420**	Research 4	Determine issue to be researched • Identify primary and secondary sources of information • Interviewing skills • Data collection interviews • Published sources, including files and records • Questionnaires and surveys • Information from professional associations • Source of information with appropriate notation. • Reference accurately and consistently. Compile findings in appropriate format • Analyse and interpret findings
400	**CO410**	Computer Skills 4	*Assumed C0310 Computer Skills 3* • Operation of personal computers and application programs as they are used in the Telecommunication industry. • Peripheral devices and interfaces to a PC used in order to down and up load files using a data transfer and database software package. • Test gear used in order to obtain measurement data.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Measurements recorded on a proforma in a central data base. − Check against set criteria, gather previous records, produce useable reports to compare and analyse records, identify trends. • Software used for a particular installation. • Software upgrades to: − Modify parts of the software program and data. − Monitor and analyse the performance of the upgraded software. − Collate data in the form of a spreadsheet to document and assess project needs, this may include personnel, tools, materials, vehicles, finance. • Documents used to aid planning, design, and management: e.g. materials supply, needs/stock analysis, availability, suppliers, costing, forecasting. • Software packages used in order to develop a project plan including timeframes, resource requirements, material list, and cost estimates, analysis of various options. • Print out drawings, documented reports and cost data.
400	**CO420**	Planning Software 4	• Integrated in Computer Skills 4 (CO410), as an application of Computer Skills and further in Planning Software 6.
400	**CO430**	Computer Programming 4	• Covered in CO620 Computer Programming 6 • Programming details can be adapted to meet the requirements of the specific competency unit/s involved.
400	**CN422**	Configuring And Optimising A Graphical User Interface	• Load and configure driver software for sound and video hardware. • Configure memory and secondary storage for optimum performance. • Implement security functions within the GUI. • Configure the environment for consistent predictable start-up. • Locate, install, and configure utility software. • Prioritise multitasking applications. • Use available data exchange techniques.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**CN440**	Database Fundamentals	• Define and correctly use terminology associated with databases. • Create and save a single table database using a database package to meet the requirements of a given situation. • Retrieve and modify the data in an existing database file. • Produce reports from a database file, according to specified criteria. • Access and use both on-line help and appropriate manuals to find information about the software package.
400	**CN435**	Digital And Computer Systems	• **Digital Principles,** Digital signal processing, Data manipulation, Data Storage, Error correction • **ADC's and DAC's,** Operating principles, Applications • **Data Transfer,** Serial, Parallel, Applications • **Time Division Multiplexing,** Operating principles, Advantages, Applications • **Optical Systems,** Operating principles, Advantages, Applications • **Digital Systems,** Examples • **Computer Systems,** Types, System architecture, Operating principles, Operating systems, Applications.
400	**CN430**	Digital Electronics 1	• Analogue and digital signal definition: Analogue - continuous, Digital - discrete or incremental. Signal measurement - eg. sine waves and digital system clocks. • Digital combinational circuit operation. • Binary numbering up to four variables. • Truth tables for NOT, AND, NOR, OR, NAND and XOR for up to three variables. • Truth table for output of two level circuits. • Boolean representation of two level circuits. • Simplification of Boolean expressions using algebra or K-maps. • Circuit implementation from Boolean expressions. • Logic probe/pulser usage for fault finding. • Hexadecimal, binary and decimal number systems and BCD code. • Hexadecimal numbering system and its BCD representation (up to two digits). • Binary to decimal conversion (16 bits max). • Binary to hexadecimal conversion (16 bits max). • Decimal to hexadecimal conversion (four hex digits max). • Representation of alphanumeric characters using 7 BIT ASCII code.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Electrostatic discharge (ESD) precautions. • Effect of ESD. • Handling of components: wrist straps, protective mats, anti-static bags. • Examples of design using ESD techniques. • Operation and characteristics of displays. • LED displays, types, calculating current limiting resistors. • LCD displays, types, drive requirements.
400	**CN431**	Digital Electronics 2	Analysis of digital sub-systems - timing diagrams to be emphasised. Decoders: • Operation (discrete components, 2 line); • Practical msi devices and applications (2 line and 3 line devices); • Seven segment display decoder (binary and bcd); • Encoders - operation (discrete components keyboard encoders); • Priority encoders; • Multiplexers – operation (discrete component, 2 line); • Truth table implementation using msi devices up to eight inputs – 'folding' not required; de-multiplexers – operation (discrete component, 2 line input); practical MSI devices. Digital sub-systems. • Examples using up to four MSI devices eg. Keyboard/display. • Data transfer – timing diagrams/data sheet usage to be emphasised; • Flop-flop operation – discrete and MSI, SR, D and JK • Level and edge triggered flip flops. • Synchronous and asynchronous inputs. • Flip-flop applications based on MSI devices for shift registers – serial and parallel loading and output. • Shift left, shift right; • Counters – based on D and JK flip-flops to a maximum of four states. • Ripple and counters. • Synchronous; • Modulus counters. • Up/down counters. • Limitations on count speed. • IC counters (MSI devices), -presetable counters (up/down), -cascading counters, (include BCD applications). • Ring counters – advantages and types. • Astable and monostable multivibrators.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Logic device terminal characteristics. • Logic levels, supply voltages, power dissipation. • Input/output drive currents and voltage levels. • Loading calculations. • Propagation delays. • Noise margins. • Switching speed limitations and speed/power product. • Open collector/drain outputs. • Tristate logic and buffers. Interfacing of different logic families (include the use of pull-up, pull-down resistors). • Schmitt trigger device input output characteristics. • At least one simple display multiplexing circuit should be constructed or tested to verify timing.
400	**CN460**	Fault-Finding And Diagnostic Skills	• Principles of analytical questioning • Drawing valid conclusions from first observations • Concepts of broad first-line testing • Consideration of/responsibility for avoidance of further damage • Interpretation of specific test results: cause/effect • Techniques for isolation to appropriate level: − Half-split − Module/function isolation (kernel technique) − Substitution − Diagnostic software • Use of handbooks, specifications, fault pathways • Software/firmware functions awareness • Assessment of effects of operator errors • Factors affecting field versus workshop repair costs • Scheduling minor/major repair activities, downtime • Implications of temporary repairs • Use of system knowledge and history • Data interpretation, expected versus actual • Recording and reporting/advising • Feedback to design/production/installation processes • Subsystems and system structures • System signals/status indicators • Known failure modes and trends • Action threshold warnings versus catastrophic failure • Component ratings/upgrades • Disassembly/reassembly techniques and care • Relative costs of repair and replacement − Remaining life − Additional benefits of replacement equipment, e.g. Improved productivity, quality − Ongoing maintenance

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**CN421**	Installing And Managing A Graphical User Interface	• Install a GUI operating system, install and run software applications from within the GUI environment. • Start, use and find information in the on-line help facility and other documentation for a GUI. • Manage files and directories on a personal computer using a graphical disk management program to create, copy, delete, move, modify, rename files and directories. • Use the print manager to manage documents sent to the printer, to install and configure printers, and to connect to printers. • Customise the GUI environment with regard to the desktop, hardware and memory.
400	**CS410**	Customer Relations 4	Client Interaction • Internal and external customers • Customer needs and expectations and the organisation's role in providing the service or product to fill these needs. • Effective working relationships with customers including: − Consider customer needs − Consult with customers − Inform customer of any services impact − Analyse customer complaints − Assess customer satisfaction
400	**CS420**	Customer Sales 4	• Enterprise Specific • Details will be determined by the needs of the enterprise.
400	**CS430**	Repair And Maintenance Obligations 4	• Follow prescribed legal and enterprise procedures for maintenance and repairs. • Inform customers of maintenance and repair procedures • Minimise customer impact. • Customer options for service and repairs • Customer addressed in a competent and professional manner how a quote is derived. • Applicable charges • Update fault history records.
400	**DI410**	Digital Theory 4	• Digital logic Integrated Circuits and MSI packages. • Operation, applications and specific characteristics • Data sheets, truth tables, timing diagrams. • Proper isolation and interfacing techniques between logic devices of different families considering the limitations of logic devices such as logic level, drive/loading, propagation delay, noise, switching speed, etc.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Circuits containing FF, SR, latches, decoders/encoders, multiplexers/de-multiplexers, counters, memory devices, A/D & D/A, microprocessor systems. • Circuit diagrams and specifications of communication equipment including radio/wireless networks to diagnose and identify affected elements, given a variety of common faults. **Note**: Digital + Microprocessor Technology
400	**DI420**	Digital Switching 4	*Assumed DI410Digital Theory* Time Division Techniques • Time division multiplexing, timeslot interchange. • PCM encoding, E1 (32 Channel) and T1 (24 Channel) frame and multi-frame structures. • Differences between A law and □ law encoding. • Reasons for synchronisation and frame alignment of incoming PCM bit streams to a digital switch. • Signal information extraction or insertion from PCM streams at switch boundary. Switch Elements • Practical implementation of a time switch. • Operation of speech memory and connection memory elements of time switching. • Practical implementation of digital space switch, • Function of space memory and digital multiplexing / de multiplexing. • Combination of time and space switching • Need for multistage switch matrixes. • Blocking probabilities with TS or ST 2 stage switches, and the need for TST, STS or TSSST. • Performance and applications for TST or STS switch matrixes in digital switching systems. • Practical digital switch stages of digital switching systems • Operation control of TST switches, of (for example) Nortel DMS Supernode or Ericsson AXE10, including path search, switch block security, processor / switch block control messages, switched control bits. • Operation of a multistage self searching switch matrix of combined T/S element as in Alcatel System 12, including switched control message protocol.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**DI430**	Digital Radio 4	Analogue radio transmissions and digital radio transmissions. • Advantages of analogue radio transmission. • Advantages of digital radio transmission. Digital modulation techniques for radio transmission. • ASK, FSK, PSK, 4PSK, 8PSK, 16QAM and 64QAM modulation techniques. • Advantages of the various digital modulation techniques. Factors which influence system implementation in digital radio networks. • 'Free space path loss' (FSPL). • Calculate the FSPL of a single hop radio link. • Define 'system gain'. • Calculate the received signal level of a radio link. • Define 'bit-error-rate' (BER). • Determine from a graph, the fade margin of a digital radio system and still maintain a specified BER. • Time, space and frequency diversity. The radio propagation phenomena which affect space wave paths. • How the space wave consists of two waves, the direct and reflected. • Advantages of space wave over rugged terrain compared to over water or desert. • Types of fading encountered in UHF/SHF radio systems. • Cause and effects on digital radio performance of each type of fading. Basic commissioning tests of digital UHF/SHF radio systems. • Measure − Transmitter carrier frequency. − Transmitter carrier power. − AGC level and determine receiver input signal level. • Receiver input level. • BER.
400	**EL410**	AC/DC Theory 4	• Covered in EL310 AC/DC Theory 3

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**EL411AN**	Electrical (Access Network)	**DC Theory.** • Describe the role of power supplies within a telecommunications installation. • Describe and draw the circuits of basic telecommunications power supplies. • Explain the terms regulation and filtering. • Calculate required components to effectively regulate and filter a rectified power supply, given necessary parameters. • Describe the following power sources, stating their advantages and disadvantages, and common techniques used to mitigate against the disadvantages when used: cells, batteries, solar panels, motor/generator or standby sets. • Discuss the purpose of protective electrodes, and describe the processes leading to the attrition of protective electrodes. (E.g. sacrificial anodes, galvanising of steel, methods used to protect aluminium) **AC Theory** • Describe various types of uninterruptible power supplies used within the telecommunications industry, giving advantages and disadvantages of each, together with the likely location or usage of each type. **Earthing Systems** • Discuss the principles of earthing and earthing systems within telecommunications systems and installations. • State the reasons for earthing within telecommunications systems and installations. • Describe, recognise and where appropriate, install the various types of earths: protection, signal, power. • Indicate, either 'in the field' or from diagrams or written descriptions, equipment and situations requiring earthing, and discuss methods of earthing. • Discuss and practically implement methods of installation of an earth system within a telecommunications facility. • Describe the processes which, after time, can compromise an earthing system. **Note**: All practical work must be carried out in compliance with the relevant legislation, where applicable. **Impedance Matching** • Explain the purpose of impedance matching circuits within telecommunications installations.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**EL420**	Impedance Matching 4	The purpose of impedance matching circuits within telecommunications installations. • Impedance matching techniques at various frequencies: power, HF, VHF, microwave: − Transformers − Quarter-wave − Stripline − Microstrip − Broadband − Narrowband • Parameters: − Lengths − Component values, − Size given an electrical situation requiring impedance matching. • Select an appropriate impedance matching technique for a given situation
400	**EL430**	Power Theory 4	*Assumed EL310 AC/DC Theory & 3EL330 Power Installation* • Distribution principles as applicable to telecommunications installations of small, medium and large size. • Explanation of power distribution within equipment racks. • Calculations showing the correct operation of graded or selective protection within equipment racks and a general telecommunications installation. • Distinguish between isolation and protection and how the principles of isolation and protection apply to power distribution within a telecommunications installation. • Purpose of the power earth and state regulations governing the power earth. • Methods of transformer construction and transformer types. • Calculate transformer behaviour, given parameters such as turns, primary voltage, secondary current, leakage flux and saturation curves. • Behaviour of transformers when supplying, rectifiers and calculate and dimension a transformer for this type of service. • Operation of and calculations about rectifier power supplies providing heavy currents. • Operation of various uninterruptible power supplies types. • Theory of Switched Mode Power Supply operation.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**EL440**	Australian Electrical Standards 4	• Australian Standard numbers and scope of Australian standards relating to the drawing/drafting of electrical building services. • Australian Standard numbers and scope of Australian standards relating to the safe installation of electrical wiring. • Parts of standards (both ACA and AS) relating to the safe installation of telecommunications services within buildings, e.g. minimum clearances, insulation strength, prohibited locations. • Interpret drawings using current electrical drawing/drafting symbols involving a wide range of commonly encountered electrical components, devices and equipment. • Interpret drawings using current telecommunications drawing/drafting symbols for the location of commonly encountered telecommunications equipment, outlets, etc. • Site plans to locate and identify building electrical services in a finished building. • Electrical and telecommunications services ducts or other provisioning for an office building.
400	**EN410**	Enterprise Escalation Procedures 4	• The 4 tier escalation system. Candidates at this level will operate at tiers 1 and 2.
400	**EN420**	Enterprise Information Systems 4	• Information systems related to obtaining information and recording outcomes for specific operations.
400	**EN430**	Enterprise Organisational Policy 4	• Observe policy in workplace interaction with other personnel.
400	**EN440**	Enterprise Operations Policy 4	• Observe policy in workplace operations.
400	**EN450**	Enterprise Policy & Practice	• Covered in EN410 to EN430.
400	**EN460**	Enterprise Pricing Policy 4	• Observe policy in workplace operations.
400	**EN470**	Selling 4	• Observe policy in workplace; interaction with customers

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**ET410**	Electronics 4	*Assumed – ET310 Electronics Principles 3* • Properties of a sine wave and various other waveforms including square, rectangular, pulse, triangular, sawtooth and their harmonic content. • Characteristics of linear, switch mode, high voltage, power supplies, their advantages/disadvantages with regard to applications, size, efficiency and safety. • Components in a power supply circuit and functions of each. • Performance limits of critical components in terms of power dissipation, applied voltage, circuit current and operating frequency. • Test and measurement under various load conditions to evaluate compliance and reliability. • Analyse test results, make recommendations to improve design. • Types of electronic transducers, their operation and interface required to electronic equipment. • Sources of Electromagnetic Interference (EMI). • Perform measurements according to International Standards, record and analyse results to determine if within acceptable limits. • Techniques that may reduce or eliminate the effects of Electromagnetic Radiation (EMR). • Test regimes and procedures to ensure that the total performance of a device/equipment is evaluated with minimal testing. • Document details of tests required and the desired outcome. • Analyse results and prepare a report outlining variances and deficiencies. • Apply a systematic approach to test various devices and equipment.
400	**ET420**	Amplifiers 4	*Assumed – ET410 Electronics 4* • Operation of amplifiers in terms of the power supply as the source of energy, the input signal as the control signal, and the output signal as being derived from the power supply as an amplified version of the input signal. • Parameters used relating to amplifier specifications: − Input and output resistance − Gain − Bandwidth − Noise − Sensitivity − Signal to noise ratio. • Applications of various amplifier types including power, current, voltage amplifiers, pre-amplifiers, AF and RF amplifiers, small signal and large signal amplifiers.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Circuits of various amplifiers using discrete components, verify all parameters are according to specifications. • Perform calculations in order to improve performance by modifying circuit design, changing components or repair. • Specifications of operational amplifiers, with a view to design, analyse requirements and select appropriate operational amplifiers and analogue integrated circuits for a range of applications. • Operational amplifier circuits with attention to selection of components, layout, insertion and removal of components, wiring, earthing, supply decoupling and safe power-on sequence. • Tests and measurements to analyse and verify all parameters specific to these devices.
400	**IN410**	Interpersonal relationships 4	• self management • personal presentation • verbal/non-verbal skills • sexual harassment • copyright and licensing parameters: software, hardware, data • mutual respect and reciprocal efforts • kinds of discrimination
400	**IN420**	Teamwork 4	**Improving team performance** • establish a supportive communication climate for the team • identify Tuckman's stages of team development • differentiate between task-related and maintenance-related roles within a team • identify the advantages and disadvantages of team decisions • identify how decisions are made in teams by authority, consensus, majority and compromise • draw up a decision making agenda • facilitate effective decision making in teams by using brainstorming and nominal group techniques • identify factors affecting participation of team members • recognise the individual needs, reactions and feelings within the team • encourage participation of all team members

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**IN430**	Negotiation 4	**Effective negotiation skills** *Assumed IN330 Negotiation 3* • differentiate between negotiation strategies and their likely outcomes − win-win − win-lose − lose-win − lose-lose • analyse Hellreigel's personal styles and the way they impact on negotiation • identify five power bases • plan for a negotiation • use principled bargaining and appropriate interpersonal communication skills to control the "emotional" atmosphere during negotiations • analyse various negotiating options − compromise − collaboration − competition − accommodation − withdrawal/avoidance • use negotiation for problem solving • obtain meaningful concessions • secure lasing agreement • establish a contingency plan, which can be reverted to if negotiations are not successful
400	**IN440**	Workplace networking 4	**Meeting procedures and participation** • Determine the meeting's purpose • Recognise the difference between formal and informal meetings • Identify the roles of chairpersons, secretary and member • Draw up and distribute an agenda that covers all the business of the meeting • Record decisions of the meeting clearly and concisely • Use meeting conversation and processes to conduct a structured meeting • Use communication skills and strategies to maintain the smooth running of the meeting • Employ problem solving strategies • Organise the venue and arrange the environment appropriately

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**NT410**	Emerging Network Technologies	This topic provides a broad understanding of the emerging communications technologies as defined by the International Telecommunications union (ITU) working party on Next Generation Networks (NGN) Technologies and principles to be covered include: • The principles of Packet-based data transfer • The separation of control functions among bearer capabilities, call/session, and application/ service • Decoupling of service provision from network, and provision of open interfaces • The range of services, applications and mechanisms based on service building blocks (including real time/ streaming/ non-real time services and multi-media) • Broadband capabilities with end-to-end QoS and transparency • Interworking with legacy networks via open interfaces • Generalized mobility • Unrestricted access by users to different service providers • A variety of identification schemes which can be resolved to IP addresses for the purposes of routing in IP networks • Unified service characteristics for the same service as perceived by the user • Converged services between Fixed/Mobile • Independence of service-related functions from underlying transport technologies • Compliance with all Regulatory requirements, for example concerning emergency communications and security/privacy, etc. Trainers and instructors should adapt, add to or delete from this list of principles as new technologies emerge
400	**MA410**	Basic Mathematics 4	• Interpret tables for locating geostationary satellites • Plot data on polar graph • Errors in measurement and estimations • Decibels – graphical plots: log, linear
400	**MA420**	Mathematics 4	*Assume MA310 Basic Maths & MA410 Basic Maths* • Trigonometry • Pythagoras • Sin, Cos, and Tan functions
400	**MT410**	Maintenance Routines	• Planning work • Scheduling work • Maintenance principles • Maintenance systems • Preventative maintenance

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**NE410**	Network Equipment 4	*Assumed NE310 Network Equipment 3* Switching network equipment. • Common hardware and software characteristics of digital switching system: − Central processor for call processing − Peripheral processor(s) for call control and traffic concentration − Switching matrix − Messaging matrix − Pools of common or shared service circuits (tone generators, etc.) − Access to trunks − Distributed call processing control. GSM network equipment. • Functions of the Mobile Station (MS). • Functions of the following Base Station System (BSS) sub-systems, − Base Transceiver Station (BTS) − Base Station Controller (BSC). • Functions of the following Network Sub-System (NSS) components, − Mobile Identity Register (EIR). − Switching Centre (MSC) − Authentication Centre (AuC) − Home Location Register (HLR) − Visitor Location Register (VLR) • Function of the Operation and Maintenance Centre (OMC). Satellite network equipment. • Main functions provided by a: − Major city earth station (mces). − Minor earth station. − Transportable earth station. Transmission network equipment. • Main components of a: − Co-axial cable transmission network. − Digital microwave radio transmission network. − Fibre optic transmission network.
400	**NE420**	Network Architecture 4	*Assumed NE320 Network Architecture* Switching network architecture. • Local exchange functions. • Hierarchical PSTN architectures. • Star and flat switching networks. • International switching networks. • Minor and major switching centre functions. • Tandem (trunk) exchange functions. • PSTN indicating the interconnection of the elements listed above.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	GSM network architecture. • The interconnection of the four major components and associated sub-systems of a GSM network: − MS − BSS − BTC − BSC − NSS − MSC − AuC − HLR − VLR − EIR − OMC • Base station antennas: − Mechanical down tilt − Electrical down tilt − Variable electrical down tilt − Dual polarisation. Satellite network architecture. • Interconnection of the Home Access Community Broadcast • Satellite Service (HACBSS). • Distribution of television programs via satellite. • Interconnection of a WAN via satellite. Transmission network architecture. • Interconnection of a: − Co-axial cable transmission network. − Digital microwave radio transmission network. − Fibre optic transmission network.
400	**NE430**	Switch Networks 4	• Covered in the Switching series (SW codes)
400	**NE470**	Forecasting Techniques 4	*Assumed NE420 Network Architecture 4* Telephony traffic basics. • Limitations of a switched network compared to a dedicated network. • Four key attributes of traffic analysis of a telephone network: − Demand − Capacity − Performance − Cost. • Estimate the traffic demand and determine the system capacity required to satisfy the demand at minimum cost within specified performance levels.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Traffic engineering concepts. • Grade of Service (GOS). − Capacity − Load. • 'Busy hour' to assess demand. • Calculate 'Erlangs'. • Traffic intensity graphs and tables. • Busy Hour Call Attempts (BHCA). • Methods of dealing with types of congestion: − Clear − Queue − Hold. Traffic forecasting techniques. • Traffic analysis and forecasting requires four steps, − Set service objectives − Determine busy hour (bh) traffic − Select correct traffic table − Look up table for correct dimensioning.
400	**OH410**	Occupational Health And Safety 4	*Assumed -OH310 Occupational Health & Safety 3 & OH320 Safe Handling Procedures 3* • Identify potential hazards which exist at the various worksite environments. • These include structural deficiencies, electrical, chemicals and gases, physical, hygiene, lighting and lightning, heat and cold, heights, ladders and scaffolding, fire and fire control, and radiation hazards. • Recommend preventative measures and take remedial action on-site. • Analyse work methods and conditions which could lead to occupational overuse, long term, and chronic diseases. • Identify factors which affect work performance. • Report and recommend preventative measures. • Analyse and evaluate specific worksite situations and take safety precautions. Such situations include remote areas and environmental factors • Specialist safety gear for climbing antenna installations • Safe use of ladders when working aloft • Scaffolding and guard rails • Working safely in wet weather • Electrical hazards in ceiling spaces • Confined spaces, shafts, tunnels and trenches • Correct posture for lifting and keyboard operation. • Identify the sources of RF hazards, measure and assess the safety at both occupational and non-occupational distance.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Compare measurements of RF levels against relevant standards considered to be safe as defined by legislation. • Perform basic first-aid functions in an emergency including EAR and CPR.
400	**OH420**	Occupational Health & Safety Regulations 4	*Assumed OH410 Occupational Health and Safety 4* • General aims and objectives of existing Commonwealth and State Occupational Health & Safety legislation. • Policies and agreements which are relevant to the installation, repair and testing of telecommunication equipment. • Employer and employee responsibilities, rights and obligations relating to OH & S. • The major functions of safety committees and representatives. • Establish a designated work group in the workplace. • Keep up-to-date with policies, agreements and safety issues published by relevant Work cover Authority.
400	**PE410**	Personal Skills 4	Time Management • Effective use of time by applying time management skills and systems • Analyse present time usage • Time wasters and ways of overcoming them • Set goals • Prioritise tasks and delegate appropriately • Workable plans for organisation for daily and long term goals • Communication factors that assist time management • How correct assertiveness skills can assist time management.
400	**PK410**	Product Knowledge 4	• Features, functions and limitations of products related to competency unit. • Alternative products.
400	**PR410**	Problem Solving 4	• Covered in PR310 Problem Solving 3

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**PS410**	Plans & Specifications 4	*Assumed 310 Plans & Specifications 3* • Manufacturers specifications − Calibration − Configuration − Test procedures − Maintenance − Action to rectify faults • Enterprise documentation − Directions & instructions − Policy relating to outages − Work order • Diagrams − Cable layout − Schematic − Block − Flow charts − Test sequence
400	**PS420**	Basic Building Trades 4	• Covered in PS220 Basic Building Trades 2
400	**PS430**	Drawing Techniques	*Assumed PS310 Plans & Specifications 3 & PS410 Plans & Specifications 4* • Requirements of customer: − Equipment − Growth − Enhancement − Enterprise policy − Time frame − Resources • Proposed Draft sketch map • Physical characteristics, existing maps/plans of site, building • Access/equipment • Heritage/environment • Basic CAD drafting • Drawing layout • Symbols and conventions • Detail, clarity • Supporting documents. • Design brief. • Verification • Modification

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**RA311AN**	Radio Frequency Theory & Hazards (Access Network)	Electromagnetic radiation hazards and safe working practices at radio sites. • State safe working practices when working with or near radio transmitting equipment. • Recognise hazard signs and need for barriers where safe levels may be exceeded. Microwave radio communication systems. • Define the meaning of the terms 'drop and insert', 'unprotected', 'cold standby','hot stand by', 'twin-path' and 'N+1'. Satellite radio communication systems. • Explain the terms 'uplink', 'downlink', 'transponders', 'footprint' and 'earth station'. Cellular phone communication systems. • List frequency bands used. • State the benefits of cellular radio. • Define the terms 'cell', 'cell splitting' and 'frequency re-use'.
400	**RA410**	Antennas 4	Site access and safety requirements of a radio transmission site. • Site access considerations. • Security issues at local and remote sites. • Issues which should be observed and reported, if at fault, at a radio site. • Safety issues which should be observed and reported, if at fault, at a radio site. • Precautions to be observed when working at heights. • Precautions to be observed with electromagnetic fields. Principles of radio wave propagation from a transmitting antenna to a receiving antenna. • Basic conversion process that occurs in an antenna. • Electromagnetic waves propagation Installation procedure for VHF, UHF, SHF and cellular antennas and feeders. • Physical differences between various antennas and feeders. • Techniques used to install antennas on buildings, rooftops, towers and masts. • Install a pipe mast, antenna, feeder and connectors. Orientation of a parabolic antenna for terrestrial and satellite reception. • Optimum orientation for a terrestrial receiving antenna using a receiver signal strength reading. • Optimum azimuth and angle of elevation for a satellite receiving antenna, given the locations, and set up an antenna using a compass bearing, tiltmeter and a receiver signal strength reading.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Faults in VHF, UHF and SHF antennas and coaxial and wave guide feeders. • Perform DC tests on coaxial cables, waveguides and antennas. • Recheck antenna alignment. • Physical checks on antennas, feeders and mountings and recognise potential problems.
400	**RA411AN**	Antennas (Access Network)	Site access and safety requirements of a radio transmission site. • List radio site access considerations. • List security issues at local and remote sites. • List general issues which should be observed and reported, if at fault, at a radio site. • List safety issues which should be observed and reported, if at fault, at a radio site. Microwave antenna systems • List the radio tower and antenna considerations of pollution, corrosion, snow, rain, heat and lightning protection • Discuss the need for tower strengthening if wind loading of antennas is excessive
400	**RA420**	Radio Frequency Theory And Hazards 4	General filters used in radio communication systems. • **Filter types**: Low pass, High pass, Band stop, Notch, Band pass. • **Terms**: Insertion loss, Bandwidth, Shape factor, Phase response. • Principles of series resonant circuits as band pass filters. • Graphs of output voltage vs frequency for a series resonant band pass filter. • Principles of parallel resonant circuits as band pass filters. • Graphs of output voltage vs frequency for a parallel resonant band pass filters. • Operation of filters using more than one resonant circuit. Specialised band pass filters used in radio communication systems. • Basic operating principle and characteristics of, quartz crystals, crystal filters, mechanical filters, comb filters, SAW filters and cavity resonators. Oscillators used in radio communication systems. • Basic requirements for oscillation. • Operation of LC oscillator circuits – Hartley & Colpitts. • Operation of crystal oscillators – Pierce & Miller types. • Operation of Phase-Locked Loop (PLL) block diagrams. • Programmable frequency-divider to provide frequency synthesis.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Amplitude and frequency modulation techniques. • Frequency products at the output of an amplitude modulator. • Time and frequency domain diagrams of an AM signal. • Calculate the AM modulation index. • Frequency products at the output of a frequency modulator. • Determine the bandwidth of an FM signal. • Time and frequency domain diagrams for an FM signal. • Deviations for TV sound, FM broadcasting, two-way radio and analogue mobile phones. AM transmitters and receivers. • Block diagram of an AM high level modulated transmitter. • Block diagram of an AM superheterodyne receiver (single conversion). • Functions of each block in the receiver and output frequencies. • Calculate the output power from an AM transmitter, modulated and unmodulated. FM transmitters and receivers. • Function of each block in a FM transmitter. • Block diagram of an FM superheterodyne receiver. • Function of each block in the receiver, and output frequencies • Advantages of FM radio systems compared to AM radio systems. • Calculate the output power from an FM transmitter, modulated and unmodulated
400	**RA421AN**	Radio Frequency Theory & Hazards 4 (Access Network)	Planning a radio network. • Discuss radio site considerations including, availability of power, all weather access, environmental concerns and site costs. Radio system design. • List performance and availability objectives. • Conduct path profile investigation between two antennas. • List possible obstructions in path profile between antennas, such as buildings or trees. • Explain path clearance using 'k' factor for earth bulge. • Explain path clearance using Freznel zones.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Radio link reliability. • Revise the term ‘multipath' or ‘frequency selective’ fading. • Discuss how space diversity, or frequency diversity, or a combination of both can reduce the effects of 'multipath' fading. • Describe how the use of twin-path, hot standby or N+1 arrangements can improve reliability. • Explain methods to combat vandalism. • List possible power backups in the events of mains failure (include battery, solar cells, diesel motor generator set). • Discuss possibility of local arrangements to connect trailer mounted motor generator set to external connection on radio hut if mains power lost for extended time periods. • Discuss need for air-conditioning in radio huts. • List the need for remote alarms at unmanned radio sites. Radio link availability. • Discuss causes of outrages. • Explain flat (rain) fading effects if frequency above 10Ghz. • Discuss outages from noise and interference.
400	**RA430**	Radio theory for wireless operations	• Describe electromagnetic transmission and reception theory • List common radio frequency bands • Draw a basic block diagram of a radio transmitter and a receiver • Define bandwidth and describe common radio and TV channel limits • List the functions of receiver stages • Describe frequency tuning or channel switching methods • Explain the function of different types of amplifiers • Name ten major events or personalities in radio history
400	**RA440**	Radio components, terminology & symbols	• Identify the components below, their symbols and usages: − microphones and speakers − rheostats and potentiometers − left, right and centre (L, R and C) − batteries − transistors − integrated circuits − special IC circuits − relays and thyristor switches − motors and generators − fuses and circuit breakers − power supply components • Describe common types of electronic displays

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**RA450**	Radio analogue circuits	• Describe basic AC and DC radio power supplies • Draw a basic audio amplifier circuit • Identify and explain the purposes of RF and IF stages • Compare AM and FM audio detectors • Explain AVC (automatic volume control) and AGC (automatic gain control) circuits and their operation • Name the major segments of a transmitter carrier generation circuit • Explain how various modulators are used in transmitters • Explain what each of the components of a transmitter power output circuits do • Draw the circuit for an operational amplifier and explain its operation • Define gain and explain how it is measured • Define bi-directional amplifier and explain where they are used • Explain the purpose and concept of PLL (phase locked loop) and VCO (controlled oscillator) circuits
400	**RA460**	Radio block diagrams, schematics & flow charts	• Identify diagram symbols used in communications radio service • Trace power and signal paths in a radio receiver and transmitter • Describe the purpose and locate schematic test points • Estimate normal signals and voltages expected at schematic locations • Describe the purpose of flow charts
400	**RA470**	Radio modulation schemes	• Describe AM (amplitude modulation) methods and limits • Describe FM (frequency modulation) methods and deviation limits • Explain the principles and advantages of single sideband – SSB (single side band) • Define TDMA (time domain multiple access) and describe the concept • Compare CDMA (code division multiple access) with TDMA and FDMA modulation schemes • Compare FDMA with TDMA (time division multiple access) and CDMA • Define and describe QPSK (quadrature phase shift keying)
400	**RE211AN**	ACA licensing standards, rules & regulations (Access Network)	• ACA role, Telecom. Act, legislative authority • ACA Technical Standards TS008, TS009

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**RE214AN**	Legislative codes, practices & access requirements (Access Network)	• Australian standards • National Trust / Heritage building codes • Local Council regulations • Site regulations • Industry codes of practice • Private ownership (access, reinstatements) • Utility providers
400	**RE220**	ACA standards & regulations: Structured cable	• ACA compliance • UL certification • AS/NZS 3080, AS 3084 • Performance certification
400	**RE221**	ACA Standards & Regulations: Optical Fibre Cable	• ACA compliance • AS/NZS 3080, AS 3084 • Performance certification
400	**RE222**	ACA standards & regulations: Co-axial cable	• ACA compliance • AS/NZS 3080, AS 3084 • Performance certification
400	**RE223AN**	ACA standards & regulations: Underground (Access Network)	• Utility providers: electricity, gas, water, telecommunications • Local councils • ACA compliance
400	**RE225AN**	ACA standards & regulations: Aerial (Access Network)	• Utility providers: electricity, gas, water, telecommunications • Local councils • ACA compliance • Height above ground
400	**RE236AN**	Regulations for Access Network	• Where work is performed beyond the boundary of the customer premises ACA regulations for cable installation are not enforced. Regulations for CAN personnel working exclusively on CAN are restricted to local and regional regulations and enterprise policy. • Enterprise specific requirements can be met with a selection of skill and knowledge sets from: − RE211AN − RE214AN − RE220 − RE221 − RE222 − RE223AN − RE225AN
400	**RE410**	Laws, Policies & Guidelines 4	• Australian building codes and regulations • Enterprise guidelines and standards • EPA, Fire and Heritage regulations • Local government Acts, laws and guidelines • Telecommunications National Code

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**RE430**	Land Acquisition 4	• Contracts for the sale of land • Vendors title • Specific parties to contracts for the sale of land • Equities in land • Leases for commercial premises
400	**RE440**	Australian Content 4	• At the time of developing this resource the Australian content regulations were under review. Refer to most current standards.
400	**RE450**	Tax And Customs 4	• Customs Tariff – interpretation rules and structure • Tariff classification and Aids to Classification • Machinery – Chapter 84 Commodities • Machinery – Chapter 84 Section and Chapter Notes • Parts and Accessories – Section 16 & 17 • Electrical Equipment, Parts and Accessories • Chapter 90 • Schedule 4 of The Tariff
400	**SC410**	Science 4	• Make accurate observations and measurement on various physical quantities. Record results on a logbook, use these to plot graphs. Interpret these results to verify predictable events, and apply to solve practical problems. Develop these skills by investigating the theories of: − Forces and motion − Elasticity in materials − Structures in equilibrium − Work and energy − Fluids and transport − Thermodynamics − Mechanical Oscillations • Accuracy of measurements and data. Identify the sources of errors, from the limitations of instruments, environmental effects, to human judgments and errors. • Qualitative statements using the mean and standard deviation of the spread of the data collected. • Theoretical knowledge of the forces of nature: gravitational, electric, magnetic fields, electromagnetic induction and magnetic flux.
400	**SU400**	Finance Principles	• Principles of Budgeting • Budgeting calculations • Cash flow and project costing • Budget targets • Monitoring and assessing expenditure • Finance variation and re-negotiation • Cost Benefit Analysis • Return on Investment

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**SU410**	Planning 4	• Organise resources and time • Set objectives • Develop work plans • Safe work practices • Employment conditions • Communicating plans to employees and customers
400	**SU415**	Human Resources 4	• Human resource management overview • Work scheduling • Workforce/workload principles • Supervision • Monitoring • Human resource policy • Industrial awards and conditions
400	**SU420**	Leadership 4	• Covered in SU320 Workplace Leadership
400	**SU430**	Quality Procedures 4	• Covered in SU330 Quality procedures
400	**SU440**	Conflict Resolution 4	• Acceptance of conflict in the workplace • Seeking information • Conflict theory – values, attitudes and beliefs • Strategies for dealing with conflict – Group processes, problem solving techniques, decision making techniques • Management awareness – cultural differences, change imposition effects, industrial democracy. **Note**: See also IN630 – Negotiation 6
400	**SU450**	Estimating Techniques 4	• Tools of estimating • Methods of extracting, recording, compiling, and calculating data • Comparison of methods • Factors and conditions affecting estimating outcomes
400	**SU460**	Finance 4	• Cash flow and project costing • Financial services – Banking System and Credit Providers • Overdraft facilities and loans • Interest rate considerations • Budget targets • Monitoring and assessing expenditure • Finance variation and re-negotiation
400	**SU470**	Project Management 4	• Overview of project management • The three phases of project management • Roles and responsibilities within project management • Project documents • Resourcing • Project reporting

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**SU480**	Materials Planning 4	• Plans interpretation – materials needs • Enterprise policy on materials purchase – tendering processes • Stock levels maintenance • Materials procurement • Preferred or approved suppliers and tenderers
400	**SU490**	Exchange Rates 4	• Information sources • Converting currencies values • Banking system functions • Alternative sources of foreign exchange • Charting optimum exchange options
400	**SW430**	Switch Networks 4	Functions of a Switching Network • Switching functions. • Transmission function. • Signalling function. Architecture of Analogue and Digital Circuit Switched Networks • Structure and generalised operation of analogue telephone networks and their limitations. • Digital networks, including transmission and switching of signals. Main Sub Units in Telephone Switching Systems • Functional blocks of a basic switching system. • Principles of step by step progressive control and common control as applied to switching systems, and compare benefits. • The service circuits used in a typical public Switching system - senders / receivers, echo cancellers, tones and RVA's, conference circuits Principles of System Control and Switch Modules. • Principles of SPC, and its advantage over wired logic. • Space Division Switching (SDS), using a cross point matrix. • Principles of "concentration" as applied to customer stage of a switching system. • State principles of "distribution" in group stages of switching systems. Structure of a Public Switched Telephone Network (PSTN) • The analogue PSTN hierarchical structure, and the principle of hierarchical routing. • Functions of each level of the hierarchy. • The digital PSTN structure and its differences from the analogue hierarchy. • Reasons for the difference between digital and analogue hierarchies. • Network synchronisation of a digital network and timing distribution technique.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Network Signalling • Differences between line signalling and inter-switch signalling. • Differences between inband signalling and outband signalling, CAS and CCS signalling. • Basic principles of R2, CCS6 and CCS7 signalling systems. Billing Operations • Call record generation and collection. • Elements of a call record necessary for charging. • Generation of charging rate via charging tables. • Unit fee, charging rate, detailed observation, bulk billing, division of revenue, call event recording.
400	**SW420**	Packet Data Switching 4	Packet Switching and Data Communication • Data communication principles via analogue and digital networks. • Need for communication protocols. • The OSI layered protocol suite for open systems. Data Multiplexing • Differences between synchronous time division multiplexing and statistical multiplexing. • Advantages and disadvantages of statistical multiplexing. • Packet Switching Principles • Data segmentation and reassembly. • Packet switching vs circuit switching and with message switching. • Calculations for optimum packet size, and message transmission time. • Virtual circuit, logical channel, data gram, connectionless and connection oriented procedures. Packet Switch Network Elements • Function of NTU's, PAD's, PAD concentrators, packet switching nodes. Packet Switch Networks • Routing and addressing and the differences for virtual circuits and datagrams. • Congestion, error recovery and queuing delays

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TE410**	Basic Telephony 4	Major Telephony System Components • Basic functions of the telephone set. • Block diagram of a basic telephone and the functions of: − Ringer − Switch hook − Dialler − Equaliser − Speech/hybrid − Handset. Telephony System Functions • Line looping. • Typical cadence patterns for the ring and busy signals. • Operating principles of telephone transmitter and receiver transducers. • Test the performance characteristics of the carbon microphone, dynamic microphone, electret microphone, rocking armature receiver and the piezoelectric receiver. • Differences between pulse (decadic) dialling and tone dialling. • Test the operation and observe the waveform of a pulse dialler and a tone dialler. Telephony System Operations • A hybrid, and its function. • Test the performance of a hybrid and show isolation across the hybrid when properly balanced. Show how this can be modified to produce sidetone. • Schematic of a 2-wire and a 4-wire battery feeding circuit and the operation of these circuits. • Diagram of a 2-wire telephone transmission and switching system and its operation. • Diagram of a 4-wire telephone transmission and switching system and its operation. Electronic Telephones • Basic differences in components between a conventional telephone and an electronic telephone. • Advanced features introduced by the electronic telephone. Cordless Telephones • Block diagram of a typical cordless phone and its operation. • Typical operating range and frequency of operation of the cordless set.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TE411AN**	Telephony (Access Network)	Signalling • List the customer 'telephone signalling' techniques. • Time Division Multiplexing • Describe basic space division switching principles, and explain how it is achieved using a cross-point matrix. • Describe the principle of Time Division Multiplexing, and describe the need for synchronisation and alignment. Basic ISDN principles. • Briefly explain what is meant by the term ISDN, and state the primary advantages of such a system. • State the data rate used for the ISDN Basic Rate Interface (BRI), and indicate the number of B and D channels. Describe a typical application for this type of access. • Determine the purpose of the D-channel. • State the data rate used for the ISDN Primary Rate Interface (PRI) in Australia, and indicate the number of B and D channels. Describe a typical application for this type of access. • Explain the function of the following devices used on the ISDN access: − (i) Network Termination 1 (NT1). − (ii) Network Termination 2 (NT2). − (iii) Terminal Equipment type 1 (TE1). − (iv) Terminal Equipment type 2 (TE2). − (v) Terminal Adapter (TA). • State the characteristics of the R, S, T and U reference points. Virtual Private Network (VPN). • Describe what is meant by a Virtual Private Network such as Centrex or CustomNet. • Describe the main features of a virtual private network
400	**TE420**	Outage And Hazard Processes 4	Hazard Management Operations • Safe working practices in the work environment. • Electrical/chemical/electromagnetic radiation hazards in the work environment. • Correct procedures for the isolation of an electrical circuit. • Safe and appropriate methods of rescuing a shock victim who is in contact with energised conductors or equipment. • Reasons for earthing. • Precautions and safe methods when entering large manholes which may contain some form of poisonous or explosive gas. • Safe and appropriate methods in the use of power tools.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Need and ways for strengthening radio towers to make up for excessive wind loading. • Precautions to be observed when working on a radio tower or any above ground construction. Outage Management Operations • Procedures involved in case of malfunction for outages depending upon the telecommunication carrier criteria and urgency of faults. • In conjunction with the various Network Operations Centres list the steps involved from when a fault is reported/detected to when it is rectified. • Functions of a test desk in dealing with fault correction. • Types of network alarms that may used even before a system becomes faulty.
400	**TE430**	Telecommunications Works Issues 4	Work Environment Safety • Occupational Health and Safety aspects according to the National Safety Standards that must be observed to promote a safe working environment. • Classify fires according to the type of combustible material involved. • The range of portable fire extinguishers and types suitable for use on electrical fires. • Conduct a civil site survey prior to the delivery of equipment to the site. • Site considerations including all weather access, availability of power, environmental concerns and site costs. • Environmental Plans (if any) of the major carriers for the protection of flora and fauna, minimisation of pollution, rehabilitation of land after construction and the protection of public safety. Equipment Commissioning and Acceptance Test Issues • Commissioning tests to be carried out by the equipment provider • Commissioning tests to be comprehensive enough for the purpose of future maintenance and fault finding. • Acceptance tests to be carried out by the an acceptance officer on behalf of the equipment operator • Acceptance tests to be validated by an agreed checklist of all the equipment functional operations. • Outcome of the acceptance tests can either be failure (nonacceptance), partial acceptance, or absolute acceptance.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TE450**	System Security 4	System Security, Privacy and Reliability. Exchange Equipment • Need for duplication of common equipment in the exchange, ways that the system detects a failed partner in a duplicated system and transfers the operation to the remaining working module. • Terms − Duplicate Synchronous Control, (DSC) − Duplicate Cold Stand-by Control, (DCSC) − Duplicate Hot Stand-by Control. (DHSC) • Error detection and correction in digital exchanges. • Importance of an accurate master clock in order to maintain system synchronisation. GSM Equipment • How digital phones encrypt (code) their transmission to provide voice security. • How digital phones use authentication and SIM card information to provide access security. • Use of the Electronic Serial Number (ESN) to protect against a stolen mobile phone. Power Supplies • Methods of providing power back-up in the event of a mains failure (include battery, solar cells, no-break power plant, UPS etc). • Use of a trailer mounted diesel motor generator set in the case of extended mains power failure. General • Methods of reducing malicious damage to telecommunications equipment.
400	**TE460**	Pager Operation 4	• Functions, principles and operation of a basic paging system. • Block diagram of both a basic VHF and a UHF pager receiver and describe the operation of the receiver section and the decoder section. • Frequencies used, the channel spacing, the frequency deviation, paging sensitivity, display characteristics and the power consumption. • Early paging coding formats used: − GSC (Golay Sequential Code) code, − POCSAG (Post Office Code Standardisation Advisory Group) code. • Codes and coding capacity and how a pager can be addressed using the above codes. • ERMES (European Radio Messaging Service) digital radio system and POCSAG system. Improved error detection and correction. • Enhancements Low Earth Orbit Satellite (LEOS) systems such as *Iridium* can provide to radio paging systems.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Perform basic tests including: − DC voltages − Pager sensitivity check − Audio measurement check − Decoder checks − Clock waveform − Amplitude measurements.
400	**TE470**	Communications Industry 4	• How such technology as Photonics, Wave Division Multiplexing, Low Earth Orbit Satellites etc. will impact on many systems as Internet, interactive services, mobile phones, pager systems and high speed data services etc. • Features and advantages of High Definition Television (HDTV). • Features and advantages of 'telecommuting' and SOHO. • Concepts of Virtual Private Networks (VPN) such as Centrex and CustomNet and their implication on the provisioning of PABXs. • Implication of such policies as deregulation of the telecommunications industry, privatisation or selling off of Telstra, sharing of mobile phone towers as much as practicable and timed local calls, HDTV etc.
400	**TE480**	Cmts 4	Basic CMTS Architecture. • Main limitations of the hard-wired (PSTN) telephone system. • Features and benefits of the Mobile Telephone Service over hard-wired traditional telephone services. • The "Cellular" concept and describe "Cell" configuration in terms of Omni Cells, Cell Clusters, Sector Cells and Co-channel cells. • Features, modulation techniques used, number range and frequency allocation between Telstra, Optus, Vodaphone and other providers • Block diagram of a GSM system showing the various transmission and switching elements and the functions of the Master Switching Centre (MSC), Base Station Controller (BSC), Base Transceiver Station (BTS), and the Mobile Station (MS). GSM System Operation. • Purpose of the HLR, VLR, AUC, EIR database registers used in the MSC. • Meaning of the following numbering systems: − IMSI − TMSI − IMEI − MSISDN − ESN, − KI.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Timing diagram to show the basic steps involved in a Mobile Originated Call to the PSTN, and a Mobile Terminated Call from the PSTN. • "Handover" • "Roaming" • The international roaming agreements between the various carriers and overseas countries. GSM Mobile Station Operation. • Facilities provided by the SIM card in the GSM phone and explain the purpose of the PIN number and the PUK code. • How the mobile station automatically adjust its own power output to allow for transmission characteristics to the BTS. • Basic tests a GSM mobile station using a test set to evaluate its performance characteristics.
400	**TE481AN**	Basic Architecture (Access Network)	• State two main limitations of the hard-wired (PSTN) telephone system. • Describe the features and benefits of the Mobile Telephone Service over hard-wired traditional telephone services. • Explain the "Cellular" concept, and describe "Cell" configuration in terms of Omni Cells, Cell Clusters, Sector Cells, and Co-channel cells. • Explain the main differences between GSM and AMPS systems in terms of features, modulation techniques used, number range and frequency allocation between Telstra, Optus and Vodaphone. • Sketch the basic block diagram of a GSM system showing the various transmission and switching elements, and describe the functions of the Master Switching Centre (MSC), Base Station Controller (BSC), Base Transceiver Station (BTS), and the Mobile Station (MS).
400	**TE490**	Blocking Principles 4	*Blocking Principles will be investigated using space division multiplexing only.* Principles of space division switching using a single-stage square matrix. • Square matrix for N-inlets and outlets showing cross points. • Calculate the number of cross points required as a function of the number of inlets. • Calculate the efficiency in the usage of cross points. • How this efficiency can be increased. • Limitations of a single-stage switch and possible solutions to overcome these limitations.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Principles of space division switching using multiple-stage switching. • A three-stage switching arrangement given N-inlets and outlets, the number of switches for the first and third stage and the number of switches for the second stage • How blocking occurs in this switching arrangement. • 'Blocking Probability '. • For a blocking switch: − Calculate the number of cross points required. − Use the 'Lee Method' to evaluate the blocking probability given the traffic per inlet, and assuming that the network is symmetrical and that traffic is uniformly distributed. • Modify the above switch into a non-blocking switch. • For a non-blocking switch with the same given conditions as above, use the 'Clos Theorem' to determine the number of cross points required for an optimal design. • Compare the number of cross points used between a blocking and a non-blocking switch and hence determine their usage efficiencies.
400	**TF410**	Test Equipment 4	Electronic test equipment (advanced). • Digital storage oscilloscope (DSO). − Features of a DSO to an analogue storage CRO. • Advanced CRO probes. − Applications of a 10:1 probe in electronics. − Applications of a differential probe in electronics. − Applications of active probes in electronics. • Frequency counter. − Applications of frequency counters in electronics. − Typical parameters, such as, frequency, resolution and sensitivity. • Noise and distortion meters. − Applications of noise and distortion meters in audio electronics. − Principles of operation of noise and distortion meters. Radio test equipment (basic). • Power meter (RF). − Typical applications for RF power meters in telecommunications. − Typical parameters, such as, frequency range, accuracy and power range. − Power head types and precautions to be observed. • Field strength meter. − Applications of field strength meters in telecommunications. • RF detector probe (DMM accessory). − Applications of RF probes in telecommunications radio equipment.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Telecommunications test equipment (advanced). • Metal time domain reflectometer (MTDR). − Applications of mtdrs in telecommunications cabling. − Principles of operation of mtdrs. − Features found in typical MTDRs. • Optical light sources, power meters and attenuators. − Applications of optical light sources, power meters and attenuators in telecommunications. − Typical features found in optical light sources, power meters and attenuators. • Optical time domain reflectometer (OTDR). − Principles of operation • Examine the operation of an OTDR. − Application of OTDR in fibre optic cabling commissioning and fault finding.
400	**TF420**	Test Analysis And Diagnosis 4	Digital circuitry testing and diagnosis. • Digital system level test analysis involves isolating the fault to one part of the system and may require the use of software. • Panel level fault diagnosis involves circuit board swapping. • Circuit board level troubleshooting involves isolating problem to a node.(a node being any signal line linking one or more gates) • Gate level fault diagnosis involves identifying the faulty integrated circuit. (microprocessor, ROM, gate, etc) Complex signal flow paths. • Different types of signal flow paths found in electronics and telecommunications: − Linear − Divergent − Convergent − Convergent-divergent − Feedback − Switching. • Linear signal path. − The linear signal path as a straight path and therefore the simplest, consisting of one input and one output with no branching or joining of signals. • Divergent signal path. − The divergent signal path as when there is more than one use for the signal involved, hence, a splitting of the signal into two paths. • Convergent signal path. − The convergent signal path as when a comparison or mixing of two signal is required and a single signal path is output.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Convergent-divergent signal path. − The convergent-divergent signal path as being a hybrid of the convergent and divergent signal types consisting of two inputs into one and then splitting into two outputs. • Feedback signal path. − The feedback signal path as sending the output signal (or portion of) back to the input. • Switching signal path. − The switching signal path as two input signals but only one being selected to be fed to the single output. Complex signal flow path test analysis. • Applications of each of the six signal flow paths in telecommunications. • Test analysis methods of each of the six signal flow paths
400	**TF430**	Fault Finding 4	• Covered in TF330 Fault Finding 3
400	**TF440**	Radio test equipment	• Explain the functions of a communications service analyser • Describe how the tdr (time domain reflectometer), otdr and fdr are used • Define swr (standing wave ratio) and show how swr and watt meters are used • Compare s/n and c/n • Demonstrate how dummy loads – dmms (digital multimeters), logic probes, pulsers and signal generators are used • Explain sinad/ac voltmeter/distortion analysers and audio generators usage • Demonstrate how spectrum analysers are used • Identify common rf test cables and converters used in 2-way communications • Describe how variable power supplies are used in service technician work
400	**TO410**	Use Of Tools 4	Electronic hand tools. • Identify a range of electronic hand tools including: − Combination pliers − Long nose pliers − Bent nose pliers − Flat nose pliers − Side cutters − Oblique cutters − Ic removers • Typical applications of electronic hand tools listed. • Demonstrate the correct procedure for using electronic hand tools listed.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Soldering tools. • Various tools used for electronic soldering and de-soldering including: − Continuous heat irons − Temperature controlled irons − Gas powered irons − Soldering iron tips: Bevel, Conical, Chisel − Desoldering iron − Desoldering block − Solder sucker − Solder wick − Solder − Isopropyl alcohol Basic soldering techniques. • Safe working practices to be adopted when electronic soldering. • Advantages of soft soldering compared to alternative termination techniques. • Effects of poor soldering techniques. • Basic soldering techniques. • Inspection techniques of soldered joints. • Rectify common soldering defects. • Shape electronic component leads before soldering onto to P.C. board. • Techniques to remove soldered electronic components from P.C. boards without damage to component or board.
400	**TO420**	Anti-Static Procedures 4	Anti-static protection in the telecommunications industry. • Anti-static protection in this topic is limited to non-radio applications. • Phenomena that are a hazard to telecommunications equipment and personnel: − Atmospheric discharges including lightning − Electromagnetic influences − Static discharges − Contact with the mains. • Optical fibre is immune from static hazards as it made from dielectric material. (unless metal conductors and/or metal strength members fitted to cable) Levels of anti-static protection. • The three levels of communications line protection: − First level of line protection as shunt devices, usually gas discharge tubes (GDT). − Second level of line protection as a combination of a GDT and a transient voltage suppressor which can be a varistor, bi-directional diode or PTC resistor. − Third level of line protection as a complex combination of gdts, transient suppressors and filters.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Isolation of customer premises equipment (CPE). • CPE attached to the mains and has a line connection is required to have line isolation, usually via an opto-isolator of 4,000 volt rating. Protection of LANs. • Coaxial cable can be protected with coaxial line filters. • Long RS232, RS422 cables can be protected with plug in surge protectors or opto-isolators. • Protection of incoming twisted pair cables. • Hybrid arrestors (second level) can be installed in banks at the MDF, or at the IDF if the equipment is outside the main building. Power line protection. • Devices used to protect the incoming mains from excessive transients: − Surge reduction filters − Shunt protection − Line filters − Line conditioners.
400	**TO430**	Hand tools & soldering for radio technicians	• Explain and demonstrate the proper usage of basic hand tools • Describe and demonstrate the proper usage of soldering irons and aids • Explain how de-soldering equipment and aids are used • Define flux and explain its purposes • Define cold – defective solder joints and list reasons they occur • Describe methods of replacing surface mount components • Describe wire wrap replacement precautions • List proper equipment care routines • Explain how hot air bonding equipment is used
400	**TR311AN**	Transmission Theory (Access Network)	History of telecommunications transmission systems. • List the transmission mediums available, namely, − Open-wire − Twisted pair − Co-axial cable − Waveguide − Radio − Optical fibre. • Discuss the transmission medium systems currently used.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Fibre Optic Concepts • Describe the requirements for safety when working with fibre optics and lasers. • Identify sources of loss in optical fibres • Identify the advantages of fibre optics compared to metallic and wireless techniques. Systems • Identify and explain the SDH system • Explain the advantages of SDH or SONET over PDH.
400	**TR341AN**	Transmission Technologies & Products (Access Network)	Transmission Technologies • List the transmission mediums which are commonly used to send information over a network, namely: • twisted pair • co-axial cable • radio (terrestrial/satellite) • optical fibre. • List the typical information transfer rates for the common transmission mediums. • Define the terms bearer and channel. • State the role and main functional blocks of a typical 'pair-gain' system in the Customer Access Network Repeaters In Transmission Networks. • Define the term repeater or regenerator in a transmission network. • Discuss the need for repeaters in various transmission networks. • Describe the basic operation of a repeater. • Discuss the term drop/insert (add/drop) used in repeaters.
400	**TR410**	Transmission Theory 4	Transmission Lines • Requirements for no distortion transmission • Performance of a transmission line • Model of the transmission line and the causes of signal degradation. Measurements Skills • Perform BER tests • Perform EYE pattern tests • Identify ISI degradation • Perform echo testing on lines.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TR412AN**	Digital Transmission Theory (Access Network)	Digital Systems • Define the term 'digital' as applied to telecommunications systemi • Describe the general transmission principle and switching structure of a digital telephone network, and explain its basic operation • Draw the basic block diagram of a digital telephone, and describe the functions of the main elements • Sketch block diagram models of digital communications systems. • List the advantages of digital transmission systems in terms of, noise, distortion, attenuation and capacity. • Discuss advantages of digital transmission as distances increase. • Explain that digital transmission systems can also carry analogue information. • Discuss integration of digital switching and digital transmission in telecommunications • Define the following terms when applied to digital communications:- sampling, quantising, encoding, quantisation error, PAM, PCM. • Draw a simplified diagram of a PCM based 4-wire digital switching system, and describe the function of each section. Digital Signals • Describe the principles of PCM and its application • Describe multiplexing as used in E1 and T1 systems • Identify sources of degradation in digital systems • Discuss cost, reliability and bandwidth factors of digital transmission systems. • Discuss integration of voice, data and image over one transmission network. Digital Modulation. • Describe pulse code modulation (PCM) as a true digital system, which converts analogue signals to a digital equivalent. • Describe the encoding process, in terms of, − Sampling. − Quantising. − Encoding. • Explain the terms, quantisation error and quantisation noise.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TR413AN**	Analogue Transmission Theory (Access Network)	Analogue Systems • Define the term 'analogue' as applied to telecommunications system • Describe the general transmission principle and switching structure of an analogue telephone network, and explain its basic operation including fundamental limitations & transmission distances • List the disadvantages of analogue transmission systems in terms of, noise, distortion, attenuation and capacity. • Sketch block diagram models of analogue communications systems. • Explain that analogue transmission systems can also carry digital information. • Discuss cost, reliability and bandwidth factors of analogue transmission systems. • Discuss integration of voice, data and image over one transmission network.
400	**TR420**	Light/Laser Theory 4	Principle theories of light • Perform calculations on wavelength, velocity and refraction of light • Chromatic dispersion Fibre Optic Concepts • Safety when working with fibre optics and lasers. • Optical fibre propagation • Sources of loss in optical fibres • Advantages of fibre optics compared to metallic and wireless techniques. • Degradation of signals in fibres • Fibre optic types Lasers/ Leds • Difference between a laser and a led. • Spectrum, beamwidth and other characteristics of lasers and leds • Modulation types used with Lasers and leds. Fibre Optic Systems • Main uses of lasers and leds with optical fibres • Main optical components of modern optical transmission systems. Systems • Advantages of SDH or SONET over PDH. Skill • Perform splicing • Perform Power measurements and loss measurements.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TR430**	Modulation Theory 4	Describe the Communication System Modulation Concepts • Signals in the time and frequency domains • Linear modulation • AM/SSB/DSB and VSB signals • Calculations on non linear modulation signals • Linear modulation circuits • Spectral and time domain waveforms of linear modulated signals • Non linear modulation • Non linear modulation circuits • Calculations on non linear modulated signals Demodulation Concepts • Demodulation demodulator circuits Multiplexing • Basic multiplexing methods Noise • Characteristic of noise • Effect of noise on analogue and digital signals. • Calculations on noise • Perform noise measurements
400	**TR440**	Narrow- & Wideband Principles 4	Characteristics and Categories of Telecommunication Systems. • Define 'Transmitter/Receiver/Media' • 'Wireline' and optical fibre • Characteristics and components of wire-pair, coaxial cable, wave guide and optical fibre media. • Functional blocks for VHF, UHF and SHF terrestrial radio systems. • Functional blocks for satellite systems. • Functional blocks for mobile telephone and data systems. Typical Signal Parameters of a Telecommunication Systems • Analogue parameters which may affect signal quality: − Loss − Noise − Delay − Bandwidth. • Effects of Signal-to-Noise Ratio on Voice, Data and Image signals (noise tolerance). • Relationship between power ratio and the decibel (dB) and the expression of power levels in dBm. Calculate dB and dBm's.
400	**TR450**	Signalling Principles 4	Basic Principle of Signalling • Concepts of signalling in telecommunications networks, its purpose and functions, and identify the signalling techniques: DC, AC, CAS and CCS.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Examples of what is meant by the following: − Address and supervisory; − Alerting − Information & test − Busy − Seizure − Disconnect • The purpose of signalling in telecommunications networks. • Differences between Decadic and DTMF signals • Principles of in-band and out of band signalling. • Characteristics of channel-associated signalling (CAS), and common channel signalling (CCS). • Signalling procedure in a PCM system (TS16). ISDN Overview • Types of services for end-to-end communications available in an ISDN. • Reference points and functional groupings of ISDN user-network interface and relate the functions of NT1, NT2 to the layers 1, 2 and 3 of OSI Reference Model. • Service used to transport SS7 signalling over ISDN • ISDN address structures (I.330 & I.331) and relationships to the telephone numbering plan E.163 and to X.121. • LAPD formats and the role of SAPI and TEI. • SS7 • Functions of signalling network elements and the SS7 architecture to the OSI 7 layer model. • Functions of network and transport levels of signalling network. • Functions of the following: signalling network elements: − Signalling Point (SP) − Signal Transfer Point (STP) − Signalling link. • Define the following: − OMAP − ASEs − ISUP − ATUP − SCCP • Functions of three types of signal unit at the signalling link level (MSU, LSSU, FISU). • Functions of the signalling network level and the SCCP. • Functions of the basic services provided by the ISDN user part (ISUP): − Content (bits and fields) of a typical test call's captured file (as provided by a protocol analyser) over the SS7 network.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TR460**	Spectrum Management 4	Spectrum Management Overview • Principles behind managing the resource known as the radio spectrum. • Characteristics and names of the ITU approved radio bands from 30 Hz to 30 GHz where radio spectrum appears within the entire Electromagnetic Spectrum • Consult a database of allocated frequencies to find the services in use at that frequency. Filters for Managing Spectrum • Plot the frequency response and Bode approximation of a simple low pass and High pass filter • **Terms**: Decade, Octave, Bandwidth, Roll off, Delay, Phase plot, 3db point • Roll off characteristics of typical filters (R-C, R-C-L, mechanical, SAW, crystal) • Transfer function for a composite network of two or three single time constant networks. • Bode plots for gain and phase by adding together the Bode plots of gain and phase of each of the component networks. • Fourier's Theorem to determine which harmonics will be present in a complex repetitive waveform. • **Terms**: 'Complex repetitive wave', 'Harmonic', 'Fundamental Frequency'. Fourier and Frequency Domain • Fourier's theorem as it applies to a complex repetitive waveform. • Addition of the successive harmonics of a square waveform to obtain a constantly improving approximation to the original square waveform. • Mathematical expressions of a complex repetitive waveform in Fourier form. • Frequency spectrums showing amplitude and frequency. • The effect on the original waveform if each of the harmonics is phase shifted by a different amount, and the effect that this may have on a data signal. • The effect of phase distortion on a complex repetitive waveform. • Frequencies of harmonics (up to and including the seventh) which will result when a pure sinusoidal signal suffers non linear distortion in a network. Spectrum Utilisation • How frequency reuse is achieved in a digital microwave network by space division • The process under which a spectrum is allocated by the SMA to a carrier • The need for guard bands • Calculate the IMD products of up to order 7 and 2 or 3 main input frequencies. • Maximum bandwidth of an AM and a FM radio systems given the modulation index and Bessel tables.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**TR470**	Transmission Technologies & Products 4	Optical Overview • Occupational Health and Safety standards for optical systems. • The development of fibre-optics and the LASER (opto-electronics). • The potential information carrying capacity of lightwave transmission (at a single wavelength). • Advantages of optical fibre systems over wireline. • The EMR spectrum and preferred wavelengths for optical fibre devices. Optical Transmission • The main characteristics of single mode and multimode fibre optic media. • Fibre index profiles (step and graded). • Advantages and disadvantages for Mode/Index types. • Types of losses in expected for fibre optic technologies • Operating wavelengths, losses and regeneration limits. • Typical configuration for SDH TDM multiplexers up to STM16 level TDM Multiplexers • Main characteristics of TDM multiplexers • Calculate typical losses in transmission paths and multiplexer technologies • Typical configuration for PDH TDM multiplexers up to E3 level Terrestrial Microwave Systems • The main characteristics of terrestrial microwave systems • Calculate typical losses over transmission paths for terrestrial microwave systems • Typical configurations for TDM multiplexers paths used with terrestrial microwave systems.
400	**TR480**	Transmission Hierarchy 4	Transmission Hierarchy Overview • Nyquist sampling theorem and the sampling rate for telephony. • Quantising levels for an eight bit PCM system and the data rate for telephony. • How companding improves quantising error at low signal levels. • The basic block diagram of a codec (one-way) and indicate which block is the anti-aliasing filter. • Reasons for using digital line transmission codes and explain RZ, NRZ, AMI, HD3B & CMI line codes. • A basic diagram of a three channel mux-demux (one way) to indicate the principle of TDM.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	PDH Hierarchy • The actual number of time slots in a PLM 30 mux-demux. • Line bit rate between a PCM 30 mux-demux system. • Three main synchronisation requirements of any TDM system. • Frame structures used to multiplex the tributaries of a PCM 30 system. • Why PCM 30 systems are often used between adjacent telephone exchanges in metropolitan areas. • The meaning of the term 'plesiochronous'. • Hierarchical structures of PDH. • PDH frame structure up to E3 and calculate the bits rates from first principles • Justification bits in PDH frames at the E2 and E3 levels. • Frame plan diagrams for PCM30 (E1) systems indicating the frame time, pulse duration, signalling and synchronising time slot allocation (FAS and NFAS) • E1 frame vs T1 frame Overview of SDH • The meaning of 'synchronous' network. • Hierarchical structure of SDH. • Methods of accessing 2M Bit/second tributaries in a SDM optical fibre trunk network. • Interworking PDH derived signals across the SDH.
400	**TR490**	Transmission Test Instruments 4	• The phases of system lifetime • Differences between the operation and support functions • Difference between installation, commissioning and acceptance testing and maintenance • System performance requirements • Test terminology and terms • Levels of maintenance • Purpose of a quality system • Standards, calibration and regulation • Purpose of test equipment • Use a test procedure to perform measurements • Produce a test report based on measurement • Perform error analysis computations • Perform measurements on BER, S/N, bandwidth, loss and crosstalk. • Use a OTDR and an optical power meter • Conventional instrument vs specific test equipment • Use automatic test equipment • Set up and program instrument control to perform a measurement

LEVEL	CODE	TITLE	CONTENT GUIDELINE
400	**VO410**	Video Network Techniques 4	• Differences between analogue and video distribution techniques over common media, such as fibre and metallic circuits • Standards for transmission of digital video signals over the telecommunications network. • Video distribution techniques • The HFC system • Satellite systems • Typical digital video switching equipment and functions • Current video switching equipment and techniques • Install and connect two items of video distribution equipment.
400	**VO420**	Video & Sound Principles 4	Video & Sound Signal Derivation. The Studio. • Typical studio layout • The need for : − Lighting − Graphics − Microphones − TV cameras − The control room − Signal transmission The Image Conversion. • A basic image converter (pickup tube) • Need for: − The lens − The transparent conducting film − Target − The scanning beam − Electron gun − Load resistor − Horizontal and vertical yokes Camera Block Diagram. • Basic block diagram of a black & white camera • Need for: − Horizontal deflection − Vertical deflection − Sync generation − Video preamplification − Sync mixing − Video output − Power supply

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	The Composite Video Signal. • Standard output signal waveform from the camera • Standard output signal waveform from the camera in terms of its: − Polarity − Level − Source impedance − Load impedance Sound to Electrical conversion. • Sketch of a dynamic microphone • The conversion process from sound into electrical energy of a dynamic microphone • Sketch of a condenser microphone • The conversion process from sound into electrical energy of a condenser microphone.

Group 5 Skills & Knowledge

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**CA520**	Training	• New and/or modified products - customers and staff • Technical information to company staff • New and emerging technologies • Training elements of supervision and reporting
500	**CI510**	Communication 5	• Technical Documents • Identify different types of technical documents • Technical definition • Technical descriptions • Technical instruction • Technical proposal • Tender • Write a technical document • Follow an agreed formal structure • Meet a specific purpose • Incorporate graphics where appropriate • Cite sources formally • Edit to industry standards • Meet appropriate completion deadlines.
500	**CN510**	Advanced Data Communications	• Data transmission system fundamentals PSTN, PSDN, exchanges, local loops switching hierarchy, multiplexers, concentrators, PCM, CODECS, line encoding techniques • Australian Data Network Services, range of services, costs, characteristics, selection criteria • Packet Switching, Austpac, protocols, tariffs, network structure • Asynchronous Transfer Mode systems, fundamentals, layers, cells, services, management • Protocols, Asynchronous protocols, RTS/CTS, XON/XOFF, echoplex, Zmodem, Synchronous protocols, HDLC, LAPB, LAPD, PPP, SLIP, Transmission Control Protocol/Internet Protocol (TCP/IP), File transfer protocols • Error detection and correction, Automatic Request Re-transmission (ARQ), parity, BCC, CRC , Forward Error Checking (FEC), hamming code, hamming distance, trellis code • Data compression techniques, Packed decimal, relative coding, character suppression, Huffman coding, and facsimile compression • Optical fibre systems, concepts, propagation, modes, bandwidth, sources and detectors, cable selection and splicing, application

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**CN520**	Advanced Internet	• Creating Web pages • Accessing the Internet • Telecommunication links to the Internet • TCP/IP protocol • DNS • SMTP and NNTP • Connecting a LAN to the Internet
500	**CN530**	Computer Systems Architecture	**Introduction** • Historical milestones in computer architecture, Review von neumann architecture, Non von neumann architectures, Review fetch decode execute cycle **Bus Architectures** • Address, data and control, 8/16/32 wide busses, Multiplexed and non multiplexed, Von neumann bottleneck, Synchronous, semi-synchronous and asynchronous data transfer • Design considerations: Reflections and termination, Crosstalk, Receivers, Transceivers and Hysteresis, Drivers, Open collector and tristate • Single user and multi-user busses: IBM PC, VME, UNIBUS **System Support** • Instruction pre-fetch pipeline, BIU, EU etc • DMA devices: cycle steal and burst modes • Peripheral CHANNEL support • Co-processors and bus interface • Typical interrupt structures: Intel, Motorola, PDP-ll Zilog etc. **CPU Architecture** • Registers, ALU and control unit • Bit slice, Harvard, stack oriented cpus • Machine code and conventional machine • Instruction set considerations • Addressing modes: direct, indirect, indexed, etc. • The micromachine control unit and data pathways • Hard wired and microcoded control unit • Horizontal versus vertical microcode considerations • Gate array, ASICS **Parallel Processing** • Flynns taxonomy: SISD, SIND, MISD and MIMD • Data pipeline, multiple functional units, interleaved memory, vector and array processors • Parallel machines: Transputer, Hypercubes, Connection machines, Dataflow machines **Operating System Considerations** • Multiprogramming systems, time-sharing • Virtual memory: overlays, physical address space, virtual address space, paging, working set, thrashing, page replacement, segmentation

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	**CACHE** • CACHE memory, locality of reference principle, hit ratio, Mapping techniques: associative, direct, set associative, Write-through, write-back **RISC Machines** • RISC versus CISC • Instruction set, register sets, etc.
500	**CN570**	Computer Systems Management	**Installation Practices/Requirements** • Regulations regarding power distribution • Delivery/packaging of equipment • Staging (i.e. Construction/test system before delivery to site) • Site inspection • 'Physical' constraints of buildings • Organisation of appropriate work team • Time table/schedule for installation • Liaison with building services personnel • Obligations towards contractors • Recording installation details **Safety/Use of Equipment and Personnel** • Occupational Health and Safety standards • Safety hazards and risks in the computer system environment • Safety systems for computer systems • Safety systems for personnel • Proper use and care of equipment • Electrical safety standards for computer, systems facilitation **Ergonomic Factors** • RSI causes and preventative measures • General ease in the use of the computer system and its peripheral devices • Causes of user discomforts and strain, relevant to furniture, air, lighting, sound, etc. **Data Security** • Security of company owned software and data, passwords, privileges, data encryption techniques • Backup facilities/procedures • Copyright laws and protections • Virus infections and their sources • Physical safe storage of master systems mass storage media **Computer System Layout and Facilities** • Physical layout • Computer/facility/room floor requirements and use • Air temperature, humidity, filtration and conditioning • Emi (electro-magnetic interference) • Power supplies (ac & dc) requirements and the use of ups (uninterruptible power supply)

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Power supply problems and possible solutions (power line analysers) • Cabling requirements and methods • Causes of corrosion, electrolysis and contamination • Esd and work practices **Ongoing Operations** • Error and fault recording • Maintenance log • Library management • Performance monitoring, Contingency planning and recovery
500	**CN551**	Data Communications Fundamentals	• Data communication standards • Basic elements of data communication system • Transmission modes: − Simplex − Half and full-duplex • Transmission techniques • Voice transmission fundamentals, Interfacing devices and standards • OSI seven layer model • Modem fundamentals • Modem modulation techniques • Integrated Services Digital Network (ISDN) • Packet switching services, X.25
500	**CN520**	Digital Electronics 3	**Digital Oscillators** • Typical circuits using the following devices:, NAND, NOR, INVERTER and the SCHMIT TRIGGER, eg. 74LS00, 74LS02, 74LS04 & 74LS14 or equivalent, 555 timer integrated circuit. Typical circuit of a crystal controlled oscillator utilising any of the above mentioned logic gates. Factors that govern frequency of operation and output wave shape. Data sheets. **Interfacing** • V_{OH}, V_{OL}, V_{IH}, V_{IL} for TTL and CMOS. Typical interface chips eg. 74HCT241, MC14050B, etc or any equivalent open collector. Typical applications of the use of logic gates with open collector outputs for interfacing. Output voltage range and output current capabilities. eg. 54/7406, 54/7407 or equivalent, Opto couplers. Typical applications of opto couplers for interfacing typical applications for Low Voltage Technology (LVT). Typical applications of bi-lateral switch eg. 54/74LS242/243 or equivalent data sheets **Busses** • Address, Data and Control busses, Tri-state bussing techniques, Factors that determine number of bits and whether a bus is Unidirectional or Bi-directional.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	**Memory Devices** • RAM Architecture and Applications, Static RAM & Dynamic RAM, NVRAM, Flash Memory, Application examples **Programmable Logic Devices** • Applications and architecture, Basic differences between PLD, PAL, PLA & GAL, Data sheets **Digital to Analogue Converter (DAC)** • Digital to analogue conversion step size, percentage resolution, V_{out}, I_{out}, V_{FS}, I_{FS} and digital input, D/A circuitry, Summing Amp, R-2R and Inverted R-2R DAC, Data sheets, Bipolar and unipolar operation **Analogue to digital converter (ADC)** • Digital ramp ADC. Tracking ADC. Successive approximation ADC. Single slope and dual slope ADC. Flash ADC. Applications and specifications. Data sheets **Application Specific Integrated Circuit (ASIC)** • Typical applications
500	**CN590**	Internet working 3	**Basic Switch Configuration** • Factors that impact on network performance, Network segmentation using repeaters, Full-Duplex, Fast Ethernet Standard and LAN Segmentation, LAN segmentation with bridges, Pros and cons of LAN segmentation with switches, Microsegmentation, How a switch learns addresses, Benefits of LAN switching, Symmetric and asymmetric switching, Cut-through, fast-forward and store-and-forward switching, An overview of the Spanning-Tree Protocol Basic VLAN Configuration • Differences between traditional switched LAN and VLANs, Benefits of VLANs, The transport of VLANs across backbones, The role of routers in VLANs, Port-centric VLANs, Static VLANs, Dynamic VLANs, Configuring VLANs, Telneting and browsing to switches, Updating IOS on a switch, Configuring VLAN trunking **VLAN Design** • VLAN Design Goals and Components, Critical components of LAN Design, Network Design Methodology, Layer 1 Design, Layer 2 Design, Layer 3 Design, Network documentation, Network documentation tools **IGRP Configuration** • The operation of routing tables, The role of metrics, Multi-protocol routing, Static and dynamic routing, Classifications of routing protocols, Interior, system, and exterior routes, Routing configuration commands, Metric adjustment, Route prediction, Routing table display and interpretation

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	**Access Lists** • Reasons to create ACLs, Flowchart of the ACL test matching process, Standard ACLs, Extended ACLs, Named ACLs, Using ACLs with protocols, Adding and removing ACLs, Modifying ACLs, Applying ACLs, Verifying ACLs **IPX** • The Novell IPX protocols suite, IPX features, IPX addressing, Novell Encapsulation, The IOS encapsulation names for Ethernet, FDDI, and Token Ring, Novell Routing, Service advertising protocol, Get nearest server protocol, Novell IPX Configuration, Monitoring and Managing an IPX Network, Using the IPX ping command **Network Documentation** • Elements of Network Documentation, Cut sheet diagrams, MDF and IDF layouts, Server and workstation configuration details, Software listings, Maintenance records, Security measures, User policies, Software tools for documentation **Network Security** • Network security issues, Network access, Data recovery, Back up operations, Redundancy techniques **Network Risk Management** • Environmental hazards (Static, Dust and Dirt , Heat), Power conditioning, EMI and RFI, Software Viruses including, Worms, Viruses, Trojan Horses **Network Performance Assessment** • Network baseline, updates and change verification **Network Structures** • Peer-to-Peer, Client-Server, Network control, Problem Solving, Scientific method, Analyse network troubleshooting, 10 step universal troubleshooting process, Multi-platform troubleshooting **Design Report Presentation** • LAN design examples, Examining specifications (a WAN and a set of LANs; one LAN per group), Designing a LAN IP scheme, Designing a WAM IP scheme, Project planning and organisation, Work distribution

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**CN591**	Internet working 4	**WANs** • WAN services, WAN terminology, Virtual circuits, WAN Devices (Routers, WAN switches, CSU/DSU, TAs, TNs, etc), WAN and the OSI Model, WAN Encapsulation Formats, WAN Link Options **WAN Design** • WAN design requirements, LAN/WAN integration issues, The First Steps in WAN Design, The three hierarchical WAN design layers, One-layer network designs, Two-layer network designs, The benefits of hierarchical WAN designs, Server placement in WANs, Alternatives to dedicated WAN links **Serial Line protocols** • PPP, PPP components, PPP layer functions, PPP Session Establishment, PPP Authentication (PAP and CHAP), Steps to configure PPP authentication, Steps to configure CHAP authentication **Integrated Services Digital Network (ISDN)** • Basic ISDN components, ISDN reference points, ISDN switches and SPIDs, E, I, and Q ISDN protocols, ISDN and the OSI Reference Model, ISDN encapsulation, ISDN Uses, BRI and PRI, ISDN Configuration Tasks, Confirming BRI operations, Dial-on-Demand Routing, DDR considerations, Configuring DDR, Verifying DDR operation, Troubleshooting DDR operation **Frame Relay** • Frame Relay Technology (Local access rate, DLCI, LMI, CIR, , committed burst, excess burst, FECN, BECN, and DE), Frame relay operation, Frame relay frame format, LMI Features , Frame relay mapping, Frame relay switching tables, Frame Relay Sub interfaces, Split horizon routing environments, The resolution of point-to-point and multipoint reachability , issues, The Configuration of Basic Frame Relay , Verifying frame relay operation, Configuring frame relay sub interfaces **Network Management** • The Administrative Side of Network Management:, What does a network look like?, Understanding and establishing the boundaries of the network, Costs of a network, Error report documentation, Monitoring the Network:, Reasons monitor a network, Connection monitoring, Traffic monitoring, Simple network management protocol, Remote monitoring (RMON), Troubleshooting Networks:, Problem solving, Troubleshooting methods, Software tools.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**CN592**	Internet working Planning	**1.General Features of** • Internet Transmission Control Protocol (TCP), Novell Internet Packet eXchange/Sequenced Packet eXchange (IPX/SPX) protocol, Microsoft NETBios Extended User Interface (NETBEUI) protocol, Xerox Network System (XNS), AppleTalk Phase 2 **2.Structures of** • IBM Systems Networking Architecture (SNA), IBM terminal types, Advanced Peer to Peer Networking (APPN) node types, DEC DECnet **3.Bridges** • Bridge performance parameters, Filter rate, Forwarding rate, Bridge design features, Learning, Redundancy, Manageability, Priority, Internetwork design using bridges **4.Router Performance parameters** • Packets Per Second (PPS) rate, Router design features: security, Internetwork design using routers **5.Gateways** • Performance parameters, Number of concurrent sessions, Protocol conversion throughout, Design features, Host connectivity options, Manageability, IBM pooled LUs, Internetwork design using gateways **6.Large Internetwork Design Principles** • Private vs public backbone links, Dedicated vs switched
500	**CN593**	Network Layer Fundamentals	**1.Networks** • Can provide competitive advantage, productivity, reduced costs • Need for addressing to avoid costs of totally meshed network • Need for alternate routes to provide resiliency **2.Description of various networks** • Connection Oriented Network Service (CONS) • CCITT standard X.25 Packet Level Protocol (PLP) • Connection Less Network Service (CLNS) • International Standards Organisation ISO8473 • Systems Networking Architecture (SNA) • Path Control • Internet Protocol (IP) **3.CCITT** • CCITT standards X.21 physical interface vs X.25 PLP • Description of CCITT standard X.121 for addressing schemes • Description of CCITT standards X.3, X.28, X.29 for asynchronous Packet Assembler Disassemblers (PADs) • Description of CCITT standard X.75 for interpacket network links

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Description of CCITT standard X.32 for dial packet connection. Description of asynchronous PADs **4.ISO Standards** • Comparisons for CONS vs CLNS **5.Austpac services** • Description of these (AOTC/Telecom)
500	**CO510**	Computer Skills 5	*Assumed – CO410 Computer Skills 4* • Knowledge of applications software with substantial expertise in: − Managing Databases − Spreadsheets For Planning − Charting − Forecasting − Collection Of Test Data For Analysis − Fault Detection, Trending − Programming Telecommunications And Test Equipment − Running Test Programs. • Install and use application specific software in relation to telephony/route, billing/charging and management of accounts • Simulate network operations • Simulate electronic circuits
500	**CO520**	Planning Software 4	*Covered in CO630 Planning Software 6.* • Software details can be adapted to meet the requirements of the specific competency unit/s involved.
500	**CO530**	Computer Programming 4	*Covered in CO620 Computer Programming 6* • Programming details can be adapted to meet the requirements of the specific competency unit/s involved.
500	**CP510**	CPE Faults 5	• Fault history patterns • Known faults/action for repair • Fault similarities • Likely faults • Methodology for identification and repair • Repair options • Backup and support during downtime
500	**CS510**	Customer Relations 5	Building a Customer Focus Organisation • Prepare a customer value package • Determine what clients value • Set customer service goals • Devise strategies to achieve goals • Implement selected strategies • Inform customers of improved customer value • Seek continuous improvement through customer feedback.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Create a service culture which focuses attention on the customer • Consider ways in which an organisation can make clients feel valued • Develop a service strategy to deliver a quality product or service • Support customer-oriented staff • Develop custom-friendly systems.
500	**CS520**	Service Agreements 5	Service agreements need to be implemented according to enterprise standards. • This topic is best addressed within the workplace.
500	**DI510**	Digital Theory 5	*Assumed – DI401 Digital Theory 4* • Logic simulators and prototype construction in the application of PLD's, ASIC's and single chip micro controllers. • Simulate and test circuits prior to construction and debug faults. Assemble test circuits to verify practical operation according to specification. • Data transmission and storage networks which employ synchronous and asynchronous data transfers, counters, and electronic switching. • Apply microprocessor technology to perform these functions within a Telecommunications, radio and satellite network. Suggest modifications to improve existing systems by re-design of software/hardware to meet present needs and allow for future expansion or technical development. **Note**: Digital + Microprocessor Technology
500	**DI530**	Digital Radio 5	*Assumed – DI430 Digital Radio* Characteristics of line codes. • Characteristics of RZ, NRZ, AMI, HDB3 and CMI line codes. • Advantages of the various line codes. • Applications of the various line codes. • Digital Modulation techniques. • Bandwidth requirements between the various digital modulation techniques: − ASK − FSK − PSK − QAM. • Advantages of base band IF or RF spectrum shaping filtering.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Digital Processing sections. • Need for code conversion. • Need for framing. • Need for scrambling with reference to clock recovery and spectra of base band signal. • Need for interleaving. • Advantages of forward error correction. • How data is added for digital order wire. Multiple Access Techniques. • Concepts of CDMA and ALOHA. • Spectral efficiencies of various multiple access techniques. • Applications of various multiple access techniques. Effects of noise and interference on digital radio systems. • BER versus carrier to noise ratio curves for various modulation schemes. • How interference degrades BER. • Typical values of receiver noise figure to relate the receive level to carrier to noise ratio. Digital tests. • Use a spectrum analyser to measure the transmitter output spectrum with digital inputs of 'all ones', 'all zeros' and 'pseudo random pattern of NRZ codes. • Use a computer simulation to plot the spectrum of at least three different line codes with pseudo random bit patterns and compare. • Plot the variation of BER with received signal level and obtain the receiver threshold. • Measure the received signal levels at which the various fault alarms are activated
500	**EL510**	Ac/Dc Theory 5	• Norton and Thevenin equivalent circuits to solve both AC and DC circuit theory problems. • Kickoff's current and voltage laws to solve both AC and DC circuit theory problems. • Descriptive explanation of Maxwell's equations. • Transient response of LCR circuits. • The application of this theory to practical situations, such as the behaviour of power supply bus bars under switching transients, sudden changes in load, lightning surges, transmission lines.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**EL530**	Power Theory 5	*Assumed – E430 Power Theory 4* • Requirements made of remote area power supplies. • Situations where RAPS would be needed. • Operation of diesel generator standby sets, governors and control mechanisms. • Calculate required capacity of alternator, rectifiers for a given situation. • Perform calculations on cell and battery capacities, for both discharge and recharge. • Write chemical reaction equations for cells in common usage. • Determine required sizing of solar cells for given applications. • Calculate and dimension regulators used with solar panels for a given situation. • Principles involved in 'changeover' from one power supply type to another. • Principles of operation of advanced UPS and be able to dimension the equipment accordingly for a given situation.
500	**EN510**	Enterprise Escalation Procedures 5	• Industry recognises a 4 tier escalation system. Candidates at this level will operate at tiers 2 and 3.
500	**EN520**	Enterprise Information Systems 5	• Information systems related to obtaining information and recording outcomes for a wide range of operations. Recognition of the impact of new information on future events.
500	**EN530**	Enterprise Organisational Policy 5	• Interpreting policy in workplace interaction with other personnel.
500	**EN540**	Enterprise Operations Policy 5	• Interpreting policy in workplace operations.
500	**ET520**	Amplifiers 5	*Assumed – ET420 Amplifiers 4* • Theory and concepts in relation to small signal amplifier circuits, specifically in systems commonly encountered in Audio/Video and Communication Networks. • Small signal amplifier circuits in various configuration. • Select the most appropriate amplifier based on the application criteria. • Construct and test these circuits using various transducers as the signal source with appropriate interfacing. • Determine parameters pertinent to each application e.g. frequency response, corner frequency, bandwidth, amplitude/phase distortion, and the effects of coupling, junction, shunt, wiring, and Millers capacitance, particularly operating at high frequencies.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Operation of open and closed loop systems, the difference between positive and negative feedback. • Effects of negative feedback on amplifier characteristics. • Analyse the operation of various oscillator circuit configurations, identify and state the specific applications of each. • Circuits for various filters and timed amplifiers as used in electronic systems. • Verify by measurement the various characteristics of a selection of practical filters.
500	**IN510**	Interpersonal relationships 5	Interview skill *Assumed – IN330 Interpersonal Relationships 3* • Be interviewed • Plan interview procedure as an interviewer • Establish a comfortable environment • Pose appropriate questions • Conduct workplace interviews: − data collection interviews − persuasive interviews − performance appraisal interviews − recruitment interviews − discipline or reprimand interviews − counselling interviews − problem solving interviews • Document an interview • Evaluate an interview • Propose appropriate follow up activities • Recognise common mistakes made by interviewers
500	**IN520**	Teamwork 5	• See IN420 Teamwork 4
500	**IN530**	Consulting methods	• Personnel involved • Question techniques • Gather, convey and receive information/ideas • Develop trust and confidence • Build and maintain networks and relationships • Identify positive outcomes
500	**IN540**	Workplace networking 5	Local networking *Assumed – IN440 Workplace Networking 4* • Identify key personnel within and outside the organisation • Create and maintain workplace network system to locate and access contacts • Apply personal and corporate marketing strategies to maximise networking opportunities • Establish links with professional associations and governing bodies affiliated with the enterprise or organisation

LEVEL	CODE	TITLE	CONTENT GUIDELINE
			• Coordinate, attend and participate in appropriate meetings and functions to facilitate workplace networking • Use appropriate formal and informal correspondence to communicate within the workplace network • Adopt time management techniques to network efficiently • Document network liaisons
500	**MA510**	Mathematics 5	Minimum • Use graphical techniques to obtain solutions of linear, quadratic, exponential, logarithmic and trigonometric functions • Manipulate algebraic expressions • Fractional , logarithmic, exponential • Simultaneous equations • Boolean algebra − Rules, symbols, manipulation • Vectors − Complex notation, polar/rectangular forms • Statistics − Presentation of data in various forms − Statistical tools − Probability theories
500	**NE510**	Network Equipment 5	*Assumed – NE310 Network Equipment 3* Integrated Services Digital Network (ISDN) equipment. • The ISDN user/network interface functions at the R/S/T interfaces. • The functions of NT1 and NT2. • The role of the ISDN access devices, − TE1 − TE2 − TA Intelligent Network (IN) equipment. • List and describe the two basic components required in an IN including: − SPC switch. − Service Switching Point (SSP). − List and describe the main physical entities of an IN, namely, − Service Switching Point (SSP) − Service Control Point (SCP) − Intelligent Peripheral (IP) − Service Management Point (SMP) − Signalling links.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Asynchronous Transfer Mode (ATM) network equipment. • Identify the ATM network equipment manufacturers and their products. • Purpose of the 36170 ATM switch. • The four line interface cards available for the 36170 switch. • The two adaptation interface cards available. • Methods of controlling the 36170 node. • Remote tasks which can be performed using the complementary 46020 Network • Management System (NMS) software.
500	**NE520**	Network Architecture 5	Integrated Services Digital Network (ISDN) architecture. • ISDN concept and its objectives. • Transmission structure of the Basic Rate Access and the Primary Rate Access. • Digital Subscriber Loop (DSL) technology. • Reference points of the user-network interfaces. • Services provided by an ISDN. • Functions of the D-channel protocols. • ISUP signalling protocol to carry ISDN services across the network. • Implications to the network of the different bearer types that can be carried as part of ISDN Bearer Services. • Signalling procedure to set up a call. Intelligent Network (IN) architecture. • Aims of the Intelligent Network. • Four planes of the IN conceptual model. • Historical evolution of the IN concept. • Current international standardisation activities. • IN services provided by the PSTN. • Implementation of a FreePhone service. • Objectives of a Virtual Private Network. • Signalling procedures to establish a 008 call. Asynchronous Transfer Mode (ATM) architecture. • Components of an ATM cell and the function of each component. • Calculate the Bit Error Rate (BER) requirements of a transmission system required for successful use by ATM. • Relationships between ATM service classes and ATM adaptation layer functions. • Transmission options for ATM and their associated framing and coding characteristics. • How cell delineation is achieved for each of the available ATM transmission options.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**NE530**	Network Signalling 5	Network signalling methods. Common Channel Signalling Number 7 (CCS 7). • Reasons for introducing CCS 7 into the PSTN. • Bit rate for CCS 7. • Terms: − Signalling point (SP) − Signalling transfer point (STP) − Signalling link − Signalling point code (SPC) − Destination point code (DPC) − Originating point code (OPC) − Telephone user part (TUP) − Data user part (DUP) − Message transfer part (MTP) • Functional diagrams which describe the interconnection of the CCS 7 network. Open Systems Interconnection (OSI) model. • The seven layered levels of the OSI reference model for data communications. • Relevance of the OSI model to CCS 7.
500	**OH510**	Occupational Health & Safety 5	*Assumed – OH410 Occupational Health & Safety 5 & OH420 Occupational Health & Safety Regulations 4* • Record and document all accidents in the workplace which cause serious injuries. • Identify report procedures to the appropriate area/person/authority. • Liaise with OH & S representatives, describe their roles: e.g. Designated Work Groups, WorkCover Authority and Inspectors. • Follow up to ensure that corrective and preventative action has taken place. • Analyse the worksite, identify and list the first aid facilities that are necessary. • Purpose of workers' compensation and describe the procedures for claiming workers' compensation. • Perform tests/routine maintenance, maintain records on power/electrically operated tools and equipment for safety and environmental safeguards. • Apply safe procedures in relation to isolation of electrical power: locking out of equipment, removing fuses and circuits, circuit breakers, RCD's and generally working safely with electricity. • Transfer electrical awareness to fellow workers.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**PE510**	Personal Skills 5	Personal Technology • The use of technological aids to improve personal workplace efficiency: − List current devices − Evaluate costs − Contrast advantages and disadvantages − Operate devices Stress Management • Recognise stress-inducing environment • Identify how personal characteristics affect stress levels • Formulate and implement strategies to reduce and cope with stress • Perform with increased creativity and flexibility • Increase productivity through effective stress management techniques
500	**PK510**	Product Knowledge 5	• Features, functions and limitations of products related to competency unit. • Maintenance routines appropriate to effective operation of products. • Alternative products.
500	**PR510**	Problem Solving 5	• Covered in PR310 Problem Solving 3
500	**PS510**	Plans & Specifications 5	• Covered in PS410 Plans & Specifications

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**RA510**	Antennas 5	Antenna radiation and reception characteristics. • Principle of operation of half wave dipole and quarter wave antennas. • Characteristics of half wave dipole and quarter wave antennas. • Characteristics of Yagi-Uda antennas. Directional characteristics and polarisation of antennas. • Application of quarter wave, half wave dipole and Yagi-Uda antennas. • Construction of various cellular antennas. • Antenna gain, bandwidth, directivity and front-to-back ratio. Characteristics of transmission lines. • Function of a transmission line. • The physical difference between coaxial cable and wave guide. • Terms: − Characteristic impedance − Attenuation − Velocity factor. • The performance of coaxial cable and wave guide at microwave frequencies. • VSWR vs return loss. Principles of parabolic antennas. • Requirements for terrestrial point-to-point radio communications. • Requirements for satellite communications. • Construction of a horn antenna with a parabolic antenna. • Parabolic antenna terms: − Gain − Polarisation − Beamwidth − Bandwidth − Front-to-back ratio. Antenna and feeder measurements. • Measure the loss in decibels of a 100 metre length of coaxial cable at various frequencies. • Plot the signal strength of a received signal while rotating a receiving Yagi-Uda antenna through 360 degrees. • Measure the VSWR of a VHF antenna and feeder. • Measure the return loss of a SHF antenna and feeder. • Perform a sweep response test of a SHF antenna and feeder.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**RA520**	Radio Frequency Theory & Hazards 5	*Assumed – RA420 Radio Frequency Theory and Hazards 4* Filter Design in radio networks. • Reasons for using filters in radio equipment. • Butterworth, Tchebychev and Bessel band pass filters using filter design tables. Signals, spectra and non-linearity. • Frequencies of harmonics which will result when a pure sine wave passes through a non-linear network. • Frequencies of the intermodulation products when two pure sine waves pass through a non-linear network. RF amplifiers in radio networks. • 'Noise figure' and 'noise factor'. • Characteristics of class A, B and C RF amplifiers. • Radio applications of each amplifier class type. • Impedance matching requirements for RF amplifiers. • Coupling methods for RF amplifiers. • Decoupling methods for RF amplifiers. Electronic components found in UHF/SHF radio systems. • Effects of stray inductance and capacitance on resistors, capacitors, inductors and filters. • How inductors, capacitors, filters and RFCs can be printed onto PC boards. • Principles of circuits using microstrip techniques. • Applications of PIN diodes, Gunn diodes, GaAs transistors, TWTs and Klystrons. Passive devices found in UHF/SHF radio systems. • Applications of cavity resonators, filters, circulators, isolators and attenuators. • Typical branching networks found in UHF/SHF radio systems. Commissioning Tests. • Transmitter output spectrum. • Carry out link frequency change. • IF amplitude and phase measurements. • Measure frequency response of transmitter and receiver filters in branching unit. • Determine the correct operation of all alarms.
500	**RE520**	Physical Interface Standards 5	• Standards, regulations, recommendations • Major organisations and regulatory bodies • Levels of standardisation : government, telecommunication administrators, industry • Australian standards: CCITT, IEEE, 802.XX, ELA232D, RS232C, ISO • Equipment approval - role of Austel, responsibilities, licence • Technical Standard e.g. TS001: safety – user, network, equipment, protective devices • Terms used – abbreviations, definitions

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**SC510**	Science 5	• Theory and concepts of transferring energy through space. • Nature of waves and their behaviour by analysis of experimental results using sound and light. • Effects of environmental factors on waves, such as gases, temperature, pressure and humidity. • Applications of special characteristics of waves such as reflection, refraction, diffraction, interference, Doppler Effect in technical, scientific, commercial and domestic scene. • Limitations of optical systems due to the wave properties of light. • Alternative means of transporting information, its viability in comparison to the existing communication systems.
500	**SU500**	Business 5	• General business principles. • Covered in SU500 series.
500	**SU510**	Planning 5	• Time management principles • Organise resources and time • Identify objectives • Develop and document critical path • Develop work plans • Safe work practices • Employment conditions • Communicating plans to employees and customers • Delegate roles and responsibilities • Progress reporting • Planning review and evaluation
500	**SU520**	Leadership 5	• Role of the Supervisor • Situational leadership • Communication skills • Motivation • Power and influence • Delegation • Enterprise specific Organisational Chart • Teamwork and the customer • Teamwork and problem solving • Negotiation skills • Team building skills **Note**: See also IN620 – Leadership In Teams
500	**SU530**	Quality Management 5	• Quality concepts • Quality management systems – Australian standards and International standards • Preparing quality system documentation • Internal quality auditing • Best practice models • Continuous improvement techniques • Quality system software

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**SU560**	Finance 5	• Covered in SU460 Finance 4
500	**SW520**	Packet Data Switching 5	Packet Switching networks • Public packet switching systems, Tymnet and Arpanet based on virtual circuit or diagrams, both external services and internal operation. • Contrast network services offered by TCP / IP and X25. • Compare routing strategies including fixed, dynamic, adaptive, flood, least cost strategies. X25 Packet Switching Standard • Operation of X25 packet level protocol. • Functions of flow control, congestion control and error control. • Role of support link layer LAPB. • Physical layer options such as X21 or RS232. • Permanent and switched V.C.'s, call control packets, logical channels. • Typical call set up and clear down sequences. Operate a Protocol Analyser • Use the protocol analyser to analyse X25 packet level and HDLC link level protocols. • Evaluate call scenarios, and understand call signalling procedures.
500	**SW530**	Switch Networks 5	Billing Operations • Process of call record generation and collection. • The elements of a call record necessary for charging. • Generation of charging rate via charging tables. • Unit fee, charging rate, detailed observation, bulk billing, division of revenue, call event recording.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TC510**	Tower Climbing 5	Ropes and Knots • Types of rope construction including diameter, materials used, lay of rope breaking strain, elastic limit and uses. • Bowline, Sheet Bend, Double Fisherman's bend, Hunters Bend, Figure of Eight, Prussic Knot and Clove Hitch. • Proper care and maintenance of ropes and how to minimise abrasion damage with rope protectors and/or running belays. Belays • Appropriate methods of placing belays suitable for the load to be held • Figures for safety factors for humans (12) and loads (5) with regard to breaking strain on belays and knotted and un-knotted ropes. • Correct placement of a 2cm Loxen bolt or anchor in concrete for use in tower climbing and its back up belay. • Placement of a belay in metal fabricated towers. Abseiling and Ascending (Prussiking) • Demonstrate and descend with the correct use of the following descenders over at least a 10m vertical tower: Figure Eight, Gold Tail, Rappel Rack, SRT Safety Descender. • Demonstrate and ascend with the correct use of the following ascenders over at least a 10m vertical tower: Jumars, Gibbs Ascender, SRT ascender. • Demonstrate the changeover from ascending (Prussiking) to descending (abseiling) and back again mid way through a free-fall rope ascent or descent. • Demonstrate the correct use of wire ladders and "pig-tails" to correctly ascend or descend over edges.
500	**TE510**	Telephony 5	CCSS • Simplified diagram of a common control switching system. Briefly explain what happens when a call is made in this system. Signalling • Customer 'telephone signalling' techniques. • 'Network signalling' techniques. SPC • Principle of stored program control(SPC), and state how it is achieved in switching systems. • Key advantage of SPC over 'wired logic' systems. • Features offered by SPC systems that are not available with electromechanical systems.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TF510**	Test Equipment 5	Electronic test equipment (professional). • Digitising oscilloscope. − Digitising oscilloscope features with digital storage oscilloscopes. Applications of digitising oscilloscopes in telecommunications. • Logic analysers. − Compare logic analysers with oscilloscopes. Applications of logic analysers in telecommunications. • Chart recorders/ data loggers − Applications of chart recorders or data loggers in telecommunications. Telecommunications test equipment (professional). • RF signal generator (microwave). − Features of microwave signal generators, such as, frequency range, stability, output range, modulation, sweep capability and input protection. Applications of RF signal generators in testing microwave radio equipment. • Spectrum analyser. • Concept of spectrum analysis. − Compare spectrum analyser to scope. Operation of a spectrum analyser. Effect of decreasing sweep bandwidth on a spectrum analyser. Applications of spectrum analyser in telecommunications, particularly, radio. Differences between a swept spectrum analyser and an fft spectrum analyser (or FFT option in digital scope). • Eye diagram analyser. − Applications of the use for eye diagrams and how they are generated. Telecommunications equipment that can be tested with an eye diagram. • Protocol analyser. − Data problem solving capabilities of a protocol analyser in various data networks. Operation of a protocol analyser in a data network. • Radio communications test set. − Test instruments found in a typical radio communications test set. Typical radio tests that can be performed using a radio test set. The ability of radio test sets to simulate cellular base stations to evaluate the performance of mobile phones. • Bit error rate testers. − Features of a typical BER tester, such as, bit, code, frame and CRC errors, errored seconds, error free seconds, AIS and alarm detection. Telecommunications equipment which can be tested with BER testers. • Constellation monitor. − Applications of the use for constellation diagrams and how they are generated. Types of telecommunications equipment that can be tested with a constellation diagram.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TF520**	Test Analysis & Diagnosis 5	Cable commissioning tests. • Copper cables. − Keep data on MTDR printouts to provide exact locations of impedance changes and cable lengths in copper cables for acceptance/commissioning tests and for future diagnosis if problems arise. • Optical fibre cables. − Keep data on OTDR printouts to provide exact locations of connectors and splices, losses and lengths of optical fibre cables for acceptance/commissioning tests and for future diagnosis if problems arise. GSM base station alarms. • GSM base station alarms extended back to maintenance centres. • Typical GSM base station alarms, such as, VSWR out of range, TX failure, channel-blocking, power, speech path conditions and entry alarms. GSM Loop back testing. • Reasons for using a GSM test mobile located at each base station, which has automatic answer and ability to loop back the line to the switch. • After hours testing of each base station channel can be remotely carried out from the switch using the GSM test mobile. Transmission equipment alarms. • Merit of multiplexing, microwave radio and fibre optic alarms extended back to maintenance centres. • Typical transmission equipment alarms, such as, BER, threshold alarms, RF signal level, wave guide pressurisation, laser power, mains power and battery voltages. Transmission equipment loop back testing. • Test analysis method of providing a software loop back at a remote transmission site for link testing.
500	**TF530**	Fault Finding 5	Cable fault finding. • Compare MTDR/OTDR traces with commissioning traces of copper/optical fibre cables. • Problems of optical fibres being longer than the actual cables. • Technique of using a cold clamp to accurately determine an optical fibre fault. Transmission network fault finding. • Automatic insertion of AIS (alarm indication signal) into a digital repeater with loss of digital input signal due to either a low RF input signal level in a radio system or a broken optical fibre. • How faulty sections can be easily isolated by determining at what point AIS was inserted into the network.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Customer complaints of poor GSM service. • Reasons why a customer complains of poor GSM service: − Mobile or installation is faulty. − Incorrect operation of mobile equipment . − Customer is outside normal coverage area. − System congested. − Faulty base station. − Customer attempted calls during outage of system or base station. − Customer likes to complain. • Problems listed can be addressed by a properly trained customer officer before being passed onto technical staff. GSM base station fault finding. • Loss of quality of coverage can usually be determined by out range VSWR alarm or low TX power alarm. • Problems which can cause reduced coverage without alarm detection: − Water in antenna. − Partial lightning damage to antenna/cable. − Damaged feeder. − Damaged, faulty or waterlogged connectors. − Obstructions since the cellular installation was completed, such as, new buildings and foliage growth. • Large modern city may have 100 cells (or about 400 antennas) and if the Mean Time Between Failures (MTBF) of the antennas is 20 years then in an average year 20 antenna failures will occur, and most of these failures will not be detected but will result in reduced coverage.
500	**TF540**	Radio Tests 5	Acceptance/ commissioning tests: • Acceptance testing is carried out by officer representing equipment operator. Commissioning is carried out by the installer (or sub-contractor). Commissioning tests should be comprehensive to provide records for future maintenance. Acceptance tests should go through a checklist which should include, power supplies, batteries, external plant and internal plant. Acceptance tests should also include safety specifications (electrical, physical, personnel and public), documentation, labelling, access requirements, inventory of installed equipment and critical spares, fault procedures, and fire and emergency shutdown information. Acceptance tests results will either be nonacceptance, conditional (partial) acceptance or absolute acceptance.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Microwave link commissioning tests (basic). • Bit Error Rate. − Procedures for measuring the BER of a radio link. − Typical bers for normal operation, and threshold. • Received signal level. − Measure the received signal level in dBm and compare to expected level calculated from link budget (including space diversity, if fitted). • Transmitter carrier frequency and power. − Measure transmitter carrier frequency and check if within tolerance. − Measure unmodulated transmitter carrier power and check if within accepted range. Alarms. • Check all alarms are functional. • Check all safety specifications, including signage, RF and lightning and earthing are met and no physical hazards exist (loose bolts etc). GSM base station commissioning tests (basic). • Transmitter carrier powers and frequency measurement − Transmitter carrier power on all channels − Transmitter carrier frequencies on all channels VSWR. • Measure VSWR on all antennas (including receive antennas). Receiver power levels. • Measure all received power levels from a mobile station at a test distance. Bit Error Rate. • Measure BER at all receivers using a loop back mobile. Alarms. • Check all alarms are functional. • Check all safety specifications, including signage, RF and lightning and earthing are met and no physical hazards exist (loose bolts etc).

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TO510**	Use Of Tools 5	Advanced cleaning techniques prior to hand soldering. • High reliability soldering. • Mechanical stresses on a PC board and its individual components. • Effects of contaminants which cause long term corrosion on PC boards. • Four main cleaning processes, • Solvent • Aqueous • Mechanical • Thermal Advanced hand soldering and desoldering techniques. • Stress relief, mount and correctly solder electronic components on a double sided PC board. • Use a vacuum solder machine to desolder and remove an IC from a PC board. • Resolder a previously removed IC onto a PC board and submit for inspection. Repair of PC boards. • Demonstrate crack, substrate and conductor repair on a single sided PC board. • Demonstrate hole and pad repair on a double sided PC board. Mass soldering techniques. • Processes, • Wave • Drag • Dip • Identify defects common to wave, drag and dip soldering. • Reflow methods of mass soldering • Vapor phase soldering (VPS) • Infrared soldering (IR). • Process defects of VPS and IR. Hand soldering and desoldering of surface mount components. • Types of surface mount devices. • Fillet characteristics of surface mount components. • Common reflow methods using hand soldering equipment. • Soldering and desoldering of surface mount components to and from a PC board.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TR510**	Transmission Theory 5	• Principles, elements and techniques of analogue and digital transmission systems. • Fundamental limits on information rate. − Digital • Requirements for digital transmission • Need to code signals • Coding systems • Source of degradation of digital signals • Higher level coding systems • Basic digital measurement methods • Perform and report results of basic digital measurements • Interpret digital test results using theory • Calculate spectrum of digital signals and determine spectral efficiency • Design filters for digital signals. Transmission Lines • Transmission lines and properties • Echoes, group delay, cornstalk and ISI. Measurement Skills • Perform basic digital tests • Relate test results to theoretical predictions • Perform basic interpretation of test results.
500	**TR520**	Light/Laser Theory 5	• Main principles of light • Calculations on the propagation of light • Optical devices: − Lenses − Diffraction gratings, − Optical fibres. • Photonic devices: − Bragg cells − Etalons − Filters. Fibre Optic Concepts • Safety when working with optic fibres and lasers. • Calculations on optical fibre propagation • Optical fibre system design and budgeting • WDM and TDM optical systems • Optic fibre performance characteristics. Lasers/Leds • Performance characteristics of lasers and leds. • Principle of operation of the laser • Principle of operation of the Led • Characteristics and limitations in performance to principles of operation in the laser and the led. • Typical laser/led values

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Systems • Detailed description of networks • FDDI and its operation • The elements of SDH, SONET and compare to PDH Skills • Characterise a laser and a led. • Use an OTDR • Perform loss measurements.
500	**TR530**	Modulation Theory & Techniques 5	Communication Theory • Concept of communication, information and analyse the type s of interference to communication Concepts • Analyse linier and non linier modulated signals • Analyse cross modulation, intermodulation and FM conversion processes • Signal quality in terms of noise sidebands, FM modulation and spectral density. • Analyse modulation circuits Demodulation • Analyse demodulator circuits Digital Modulation • Digital modulation schemes • Compare different modulation methods for efficiency of information transfer, bandwidth and performance in the presence of noise. • System requirements of modulation systems
500	**TR540**	Narrow- & Wideband Principles 5	The Fundamental Limitations on Information Transmission Speed. • Hartley's law and Shannon's law • Maximum transmission speeds using Hartley's law and Shannon's law. • Inter symbol interference and its relationship to the Shannon limit on transmission speed. • Raised cosine/Gaussian pulse shaping, modulation and coding methods to increase transmission speeds(e.g. T-QAM). Signal degradation effects on transmission channels and methods used to minimise these effects. • Amplitude and phase response of an ideal transmission channel and a practical channel • Effects of group delay and purpose of equalisation in practical channels. Basic Information Theory Concepts • How information is measured and its relationship to the probability of an event occurring. • Entropy of text and telemetry signals • Signal redundancy inherent in human text language and that further caused by coding.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Calculate the information content of a simple text message and telemetry signal. • Redundancy reduction (data compression) techniques. Variable length codes, Huffman codes, adaptive scanning, fax compression, V.42. Data Communications Basic Bandwidth Utilisation • Limits on RS-232 interface connection, voltage, speed, distance. • Interface standards that extend the serial interface capability (i.e. RS-422, RS-485, RS-449, current loop, line drivers, opto-couplers). • Limits on LAN standards AS4804.3, 4804.4. Error Correction and Detection • General principles and application of CRC's as FCS on data blocks. • Application of FEC techniques. • A 3 out of 7 Hamming code used for FEC and its error correction capabilities
500	**TR550**	Time Division Multiplexing 5	ISDN • Main features of Narrow band and Broadband ISDN. CCITT (ITUT) definition of ISDN. Structure of the I-series of standards. Reference configuration for BRA and PRA showing the reference points and functional groupings. Abbreviations: • CPE, CAN, ET, LT, NISDN, BISDN, SPCS, MSN. Digital Frame Structures • How an analogue signal is converted to ADPCM. How the ISDN user channel rate of 64Kb/s is derived. Rate adaptation. Using appropriate telecommunications software, set up a voice call on a real or simulated PCM Network. Layer 1 • Channel structures and data rates for Narrowband ISDN services applicable in Australia. Fundamental principles of Layer-1 of ISDN. Typical messages for Layer-1 of ISDN. Binary fields and bits organisation of Layer-1 (i.e. fields D, F, L, E, N, B1, B2, A, S, M). Line coding schemes in ISDN and coding schemes used for BRA and PRA. Protocols • Protocols for Basic Rate Access. The ISDN protocol stack in relation to the OSI seven layer model. The fields in the HDLC frame and the application of HDLC frame to X.25 and ISDN. Conceptual overview and function of the ISDN LAPD protocol. Acknowledged and Unacknowledged operations specified within the LAPD protocol. Types of LAPD frames and the fields within the frames. 'Bit stuffing" and highlight some of its pitfalls.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• The meaning of the LAPD messages given the control field encoding of LAPD commands and responses (RR, RNR, SABME, UI, DISC, FRMR, DM). Typical Layer-2 messages using appropriate time sequence diagrams. Functions of ISDN Layer-3. Sequencing • Time sequence diagrams for an Intra ISDN call between subscribers showing the various Layer-3 messages for call establishment and call clearing. Analyse a captured ISDN traffic file used for telephony or data and carry out a full analysis of the calls history. ATM • Key aspects of BISDN and ATM. Technological transition from circuit to packet switching in a BSIDN environment, and the use of frame relay in this context. ATM adaptation Layer (AAL) when ATM is used across the user-network interface of a BISDN.
500	**TR560**	Spectrum Management 5	Radio Spectrum • Use a scanner to check and log "traffic" on a spot frequency. • Principles of two way radio communications. • The operation of a radio repeater • Principles of trunked radio systems • Principles of Selcal radio paging for dispatching messages and establishing a voice channel. • Use a spectrum analyser to check the performance of a two way radio. • Describe the steps to be used to find the source of a spurious radio emission. Filters – Design • Determine the required order number of a Butterworth low pass or high pass filter having been given the required cut off frequency and the stop band attenuation performance. • Design Butterworth or Bessel low pass and high pass filters using filter design tables • Design a Butterworth, Tchebychev, or Bessel band pass filter using filter design tables • Construct a band pass filter and measure its frequency-gain response. • Verify the design of a high pass band pass and low pass filter or other linear circuits using a circuit simulation computer program such as PSpice, Micro-Cap IV, or Electronic Workbench. • Difficulties which arise from the use of practical components to construct a filter and the measures which must be used to overcome these difficulties.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TR570**	Transmission Technologies & Products 5	Fibre Optic Safety and overview • Brief history of telephony from the narrowband single channel bearers to broadband bearers, and early optical communications through to fibre optic communications. • Compare fibre optic signal paths to those offered by copper cables, microwave links and satellite links. Transmission Technology • Compare fibre optic links with copper cable links, microwave links and satellite links • Likely future trends for fibre optic communications. • Advantage and technology offered by the "fibre amplifier". • Advantage offered by the "synchronous coherent" light modulation. • Perform calculations on the velocity of light in a transparent material, angle of incidence, angle of reflection, critical angle, Snell's law and numerical aperture, coupling efficiency. • Terms: − Total internal reflection − Wavelength dispersion, • Fibre propagation modes and their advantages and disadvantages, fibre index profiles and their advantages and disadvantages and common fibre optic cables. • Perform calculations on a fibre optic link within a wide area network. • Function of amplifiers (underground and undersea), regenerators (underground and undersea) in fibre optic systems. • Typical customer access network using fibre optic multiplexers. LANS and WANS • Function of the components of a Metropolitan Area Network (MAN). • Function and typical position of: hubs, routers and exchanges. • Main local area network systems which use optical fibres. • Types of Ethernet available for operation with fibre optic cables. • Main functions of an Ethernet LAN. • Operation and configuration of an FDDI network. • Typical data rates, terminal separation and cable types used for the networks above.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TR580**	Transmission Hierarchy 5	Products and Services • Compare commonly used telecommunication products and services, including their source characteristics. • Time and frequency domain representations of audio, data and video electrical source types. • Major telecommunications services or product families used in Australia to carry audio, data and video information. • Various transmission signal options used in networks and limits of commonly used customer premises equipment that generate these transmission signals. Transmission and Encoding Theory • Factors determining the usable bandwidths of twisted pair, coaxial, satellite, microwave and fibre optic channels. • Why it is necessary to accommodate source signals to channels. • Why analogue telephone line Modems are currently limited to data rates of less than 56kbits/sec. • Identify the modulation techniques used as FSK or ASK. • Why AM radio broadcast transmission has a lesser sound quality than FM radio transmission. • Identify the encoding technique used as NRZ-L, NRZI, Bipolar AMI or Manchester. Media Access Methods • The role and function of transmission media access techniques. • Various media access methods used for telecommunications networks: − Scheduling (TDMA, polling, Token passing) − Random Access (ALOHA, CSMA, CSMA/CD) • Relative advantages of each media access method to justify it being chosen for a particular application. • Typical application example of each access method. • Why (in addition to the bandwidth of the transmission media) the chosen access method can affect the information transfer rate. • The role, function and implementation of circuit, packet and fast packet switching. • The role and function of transmission backbones with respect to commonly used transmission mediums. • Functions of commonly used high speed transmission backbones. Transmission backbones including: • Digital TDM − PDH − SDH/SONET − FDDI • The layout of the fixed copper and fibre optic cable infrastructure used by Australian telecommunication carriers.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
500	**TR590**	Transmission Test Instruments 5	• The structure of a system • Logistics support functions • The role of quality systems • Maintenance philosophy • Test philosophies and the role of testing • Testing terminology • Essential elements of a quality system which relate to test equipment • Standards, calibration and methods to achieve these • Use a test procedure to perform measurements • Analyse measurement and produce a test report • Compute errors in various transmission measuring equipment • Use various test instruments in automatic and manual modes to acquire measurements • Interpret instrument specifications for testing application • Produce a simple test procedure
500	**VO510**	Video Network Techniques 5	• The differing requirements of broadcast video distribution and video telephony. • Transport of digital video signals over various transmission systems and media: − SDH − ATM − FDDI − ISDN − H channels − B-ISDN − HFC − Optic fibre − Copper/coax − Satellite/wireless. • Report on a video distribution system, e.g. Parliament House. • Report on the installation, commissioning and repair of any video distribution equipment. Sources may include manufacturer's equipment manuals, work experience, attendance at training sessions or laboratory work. • Report on video switching, multiplexing and transport equipment.
500	**VO520**	Video & Sound Principles 5	The Perception of Light and Colour to the Eye • The Glass Prism and the colour spectrum − Split white light into the colour spectrum • Function of "rods" and "cones" in relation to light entering the eye

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Terms: − Hue − Brightness − Saturation − Chromaticity • The eye's sensitivity to various colours using a general response curve The Electromagnetic Spectrum • The frequencies / wavelengths of the Red, Orange, Yellow, Green, Blue and Purple/Violet visible light • The Light Characteristics of Colour Striped Filters − four lines generated from the filters (N line, N+1 line, N+2 line, line) • The Charge-Coupled Device (CCD) Image Sensor • The operation of the CCD sensor using a simplified diagram • "Charge Packet" transfer using digital transfer techniques • Methods by which the image is transferred to the output terminals of the CCD camera.

Group 6 Skills & Knowledge

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**CI610**	Communication 6	Reports and Submissions • Plan and write a long report and/or submission • Define the purpose of a submission • Develop an effective plan to produce a long report or submission • Use an appropriate format to write a long report or submission that gives the reader: − Information and evidence, − An analysis of information, − Conclusions, − Recommendations • Present a Report • Deliver an oral presentation based on the document
600	**CI620**	Research Skill 6	Undertake a Project • Research and analyse information specific to a project topic • Generate a range of technical solutions and select the most appropriate • Design, evaluate and finalise this solution • Organise and manage research process.
600	**CO610**	Computer Skills 6	*Assumed – C0510 Computer Skills 5* • Demonstrate specialist knowledge in the use of software and available data to analyse network design, manage technical and personnel functions, and generate concepts for growth and improvement. • Identify the sources of relevant data. Collect and analyse this data using software packages to: − Determine site/channel capacity, forecast future needs − Measure traffic levels and patterns − Prepare a plan to indicate network growth potential − Prepare a time chart to meet such growth − Prepare a report e.g. Project brief complete with options, costs, outcomes, budgeting, timing, maps, plans and detailed description of project. − Measure the performance of the network by trend analysis, statistical and comparative data analysis. E.g. Meantime between failures is established using historical data and real time analysis of data − Optimise database − Prepare a business plan in line with forecast network growth, within resource capacity, timeframes, technological advances, and impact on existing systems. • Devise methods of testing new software to verify its compliance with existing hardware. • Install and run test programs, monitor the performance of both software/hardware to forecast potential problems.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	**Note**: This topic has units relating to network security codes, access, system platforms - which belong to another topic C0660, Forecasting in C0640, Planning in C0630.
600	**CO620**	Computer Programming 6	*Assumed – CO610 Computer Skills 6* • Demonstrate specialist knowledge of information systems used in the planning, design and installation of the network. • Undertake system design and configuration using available software programs. • Develop project management plan using techniques such as check lists and Gantt charts involving program development and use of software packages. • Produce quality project management plans using process flow charts identifying all activities.
600	**CO630**	Planning Software 6	*Assumed – CO510 Computer Skills 5* • Demonstrate specialist knowledge in the use of software tools to source and collate existing data • Analyse, make judgments and decisions to plan and manage large projects. • Effectively use various management applications software packages of project planning and scheduling such as flow charts/Gantt charts to: • Develop a project management plan, timeframes, resources, barriers and contingency actions, skills and training, priorities, specifications, costing, expenditure and risk analysis of various financial options. • Produce documents of plan outlining tasks, process flow, timeframes, resource requirements and financial details. • Prepare a project brief including various planning options, cost/benefit studies, costing estimates and profit margins, project timing. • Use techniques such as checklists and Gantt charts, which involve development and use of software based programs. • Produce a clearly documented brief which meets the specifications of the approved network project plan, specified timeframes, within financial capacity and policy, specified planning processes including associated monitoring and control mechanisms.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**CO640**	Forecasting Software 6	*Assumed – CO510 Computer Skills 5* • Demonstrate specialist knowledge and skills in the use of forecasting software packages to plan the development and growth of the telecommunications network by: − Accessing and gathering relevant data such as: demand from carriers and resellers, current capacity, current traffic and quantity of flow, financial capacity and resources. − Interpreting interrogating and use of relevant data bases. − Identify growth patterns − Develop a clearly documented plan taking into account other parameters which give rise to alternative options, such as, new and emerging technologies, priorities, timing, other projects, marketing, financial capacity and goals. − Develop a business/marketing plan with preliminary costings. − Show a cost/benefit analysis. • Collate the data from the growth plan above to generate forecast figures using appropriate forecasting techniques e.g. trend analysis, mathematical modelling • Compile figures to produce various reports by changing parameters. • Review forecasts at regular intervals after each activity or amendment or technology change.
600	**CO650**	Management Information Systems 6	*Assumed – CO510 Computer Skills 5* • Demonstrate specialist programming skills in using or adapting appropriate software for data collection methods specific to telecommunications equipment. • Gather data from various information systems presently used: − Network condition information is obtained from • Capacity assessment data • Traffic dimensioning data • Network performance data which is available through the various network management tools associated with the network. • Customer information is gathered from both marketing and account management sources. • Access and security for information systems. • Data processing terminology • Update systems after installation/amendment

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**CO660**	Operating Systems 6	**Part A** *Assumed – CO620 Computer Programming 6 & CO680 Software Management 6* • Demonstrate broad knowledge of general operating systems − MS DOS commands, file organisation, system and BIOS calls − Hierarchal directories − Customising MS DOS − MS DOS batch files − Pipes, filters and I/O redirection − TSRs and device drivers − New and emerging trends in operating systems − Create files and directories, use the system commands to perform process operations within a multi-user, multitasking environment − Real time applications − Interleaved processing techniques − Multiprogramming − Multitasking − Time-sharing − Virtual storage − Multiprocessing • Language translators − Compilers − Interpreters − Assemblers
600	**CO660**	Operating Systems 6	**Part B** • File and disk organisation − Files and directories. Protection and permissions. Listings. File location. Classification • System command and calls − Commonly used commands, Retrieving, Saving, Deleting, Copying, Creating, Printing, Linking etc., Input/output redirection, Meaning of, Method of achievement • Batch, script or equivalent files − Purpose, Structure, Commands • System utilities − Sorting, Windowing, Device drivers

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Use the wide ranging capabilities of an operations system to: − Devise and undertake network tests to check network performance in real time to gather data/information from all sources. Analyse drive test data to check for network optimisation. Administer platform database optimisation using software redesign and hardware variations. Interrogate system to identify error logs, aging time on processes, database checks and system loading. Assess availability of data storage. Initiate procedures for data backup, review for efficiency and amend. Create/delete/modify user accounts – groups, profiles, access levels, security, verify deletions prior to action. Make a system backup and system recovery from backup. • Measure: − The platform performance, Application responsiveness. System utilisation (ram, cpu, hard drive). Simulate problems and faults to determine shortcomings of software/hardware.
600	**CO660**	Operating Systems 6	• Prepare for configuration/reconfiguration of system so that there is no loss of traffic during integration or upgrade lead data for test environment. • Analyse the CCS network to ensure that it operates according to specifications: − Activate alarm screens. Check port times. Unblock ports, check integrity of data received. Activate test messages, check for receipt. Investigate the causes of alarms/problems commonly reported. e.g. fault on hard drives, security breaches, software design, storage. Determine appropriate repair action. • Implement software changes in accordance with planned strategy, including short term ad hoc solutions. • Develop and implement appropriate strategies for performance enhancement. • Investigate spare capacity of the network which can be enabled during repair. • Identify route/circuit unavailability. • Interrogate the system to identify traffic status/problems both real and potential. • Activate controls automatically or manually to monitor traffic, collect data in real time, such as call gapping and rerouting. • Identify system platforms and applications including UNIX, HP open view, SUN operating systems, Command Post.
600	**CO670**	Planning Applications Programming 6	• Covered fully in Planning Software 6 (CO630) and Forecasting Software 6 (CO640), and Computer Skills 6 (CO610).

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**CO680**	Software Management 6	*Assumed – CO610 Computer Skills 6* • Produce a flow chart and write high level language programs to illustrate the concepts and use of: − Multitasking operating systems − Event driven and polling routines − Abstract data types − Data driven programs − The use of languages specific to telecommunications − Client/server paradigm as a tool in telecommunications network management. • Reconfigure design to meet Australian standards and ensure full compatibility with existing networks and specifications. • Design a test regime to check that amendments function correctly and test the impact of existing system. • Develop a systematic approach to software problem diagnosis and elimination of causes. • Customise new and enhanced systems to meet the needs of potential customers by creating new concepts and ideas. • Set up a simulated test environment for trialing a model network.
600	**CO690**	Unix Systems Platforms	**Part A** *Assumed – CO660 Operating Systems 6* • Demonstrate specialist knowledge of the UNIX operating system by navigating the various environments – user, programming, and administration. • Access the internal data structures and algorithms to design and reconfigure telecommunications equipment. − Concept of a process − Process control block − Process table − Concurrent and parallel execution − Queuing − Priority − Scheduling policies − Resource sharing − Parallel processing − Spooling − Process states and transitions − Interprocess communication − Mutual exclusion − Synchronisation − Deadlock − Semaphores and messages

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• System Organisation − Development history, versions and standardisation − The system environment − Basic system architecture − Files and directories − Directory structure − Naming conventions − Types of files − Special device files − Organisation and contents of root file system − System documentation • File Systems − Structure of a file system − Directory files and directory entries − System tables for controlling file access • Control of Processes − Memory management scheme − Scheduling options − Pipes and synchronisation − Mutual exclusion − Interprocess communications
600	**CO690**	Unix Systems Platforms	**Part B** • Command Shell − Logging in − Password maintenance − Terminal characteristics − Automatic startup files − Environment variables − Special system variables − Command execution, foreground and background − Common file and directory commands − List/print contents − Create − Copy − Move − Remove − Change directory − Link − Search − File and directory security − Ownership and access permissions − Default permissions − Changing permissions − Common commands for − User communications − System enquiries − Print queue operation − Control of process execution − Redirection and standard system devices − Pipes and filters

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Shell Programming − Operation of system editor − Creating/executing shellscripts − System login script − Shell variables − Shell arguments − Meta-characters − Command substitution − Use of shell commands for − Choice − Looping − Input and output • Using the UNIX utilities analyse the log files to: − Determine the causes of faults in the Telecommunications network, which could be due to traffic/status problems, route/circuit unavailability, capacity of system, hard drives, security breaches, software design, data storage. − Analyse fault history and patterns − Devise a methodical approach to solving problems in the shortest time possible. − design programs and codes to simulate faults in a captured environment, isolate, identify and correct faults or deficiencies in the system. • Establish a test regime for gathering data from various sources in real time, to analyse the performance of the telecommunication systems and equipment. − this requires installation of software, writing test programs − modify/customise equipment to interface to the UNIX system. Modify software/hardware. • Use the UNIX network tools to monitor the telecommunications network to check the stability/capacity/integrity of a piece of equipment/system. • Collect and collate data relating to the faults listed above. • Analyse data to identify major deficiencies, recommend changes. • Reprogram equipment as required or after a fault has been rectified. Reconfigure the design of system.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**CS610**	Customer Relations 6	Components of communication (verbal, non-verbal, written, visual, audio-visual, emotional factors) • Effective customer service • Identify Internal/external customers • Formal and informal networks relating workgroup to customers • Customer requirements determined using customer terminology • Customer characteristics in relation to product and service requirements • The features and benefits of products and services relevant to customer requirements and characteristics are described, and feedback sought • Providers capacity to meet customer requirements and where appropriate, the organisations marketing and pricing policies • Other workgroups which should be notified of client requirements and/or characteristics are identified and advised • Processes to obtain client feedback on product quality and service levels provided
600	**CS620**	Service Agreements 6	Service agreements need to be implemented according to enterprise standards. This topic is best addressed within the workplace.
600	**DI610**	Digital Theory 6	*Assumed – DI510 Digital Theory 5* • Fault reports of existing telecommunications systems. • Tests and measurements to identify deficiencies in designs both software and hardware of new and existing equipment. • Target modules and techniques which are more likely to be the cause of trouble in the area of interfacing, data link control, synchronisation and circuit switching. • Analyse the design, construction, and features of the most complex telecommunications equipment to identify improvements, enhancements, and compatibility with existing equipment and software. • Simulated environment and establish test conditions to verify the performance of new software and hardware. • Design and performance issues of the mobile network, concepts in design and recommendations for converting an unreliable transmission link. **Note**: This topic may overlap with Fault Finding, Test Equipment, Test Analysis and Diagnosis, Network Equipment, Network Management Principles and Capabilities.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**DI630**	Digital Radio 6	Minimum shift keying digital modulation techniques. • Differences between MSK and GMSK. • Phase trajectory of MSK/GMSK. • Differential encoding in GMSK. • Compare GMSK and DAMPS digital modulation techniques. Speech coding techniques. • Speech coding techniques, ADPCM, AVSD/CVSD, APC. • Voice coding based on modelling of the human voice. • Linear Predictive Coding (LPC) technique. GSM speech coding. • History behind the selection of the GSM coder algorithm. • Three main requirements for GSM speech coding: − Exploiting redundancy in human speech − Exploiting pauses in natural flow − Maintaining speech quality as good as analogue cellular. • Operation of the Long Term Predictor (LTP) part of the GSM coder. • Operation of the Regular Pulse Excitation (RPE) process. • Operation of the LTP LPC/RPE coding process used in GSM. • Bit allocation of the GSM speech coder. • Discontinuous Transmission (DTX) technique. • Ciphering in GSM. • Encoded voice bit rate. • Gross bit rate after forward error correction and channel coding bits to speech transmission. GSM enhancements. • Compare phase 1 GSM with phase 2 GSM. • Enhanced full rate speech coding. • Half rate speech coding and its future impact on system capacity. • Compare data services offered by GSM. • CDMA in GSM networks. • Supplementary services available now and in the future including: − Call barring − Call waiting − Call hold − Conference calls − Calling party ID. Computer simulation. • Simulate the interleaving process and forward error correction process with a computer program and comment on its effectiveness with burst errors of varying length.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**DI640**	Digital/Analogue Network Applications 6	*Assumed – DI510 Digital Theory 5* • Demonstrate in depth specialist knowledge of Digital Signal Processing (DSP) and the various applications in the telecommunications network. • Block diagram of a DSP system identifying all major blocks. • Refer to applications such as: − Audio Response Equalisation, (ARE) − Echo cancelling on telephone lines − Tracking filters for radio communication − Line repeaters − Channel multiplexing − Data encryption − Digital speech interpolation − X.25 packet switching − Video conferencing − Security access − Digital radio − Voice commands − Modems − ADPCK transcoders − DTMF encoding/decoding − FAX − Mobile network. • The sampling process and how it changes the signal. • Shannon's Sampling Theorem. • Calculate quantisation noise introduced by A/D and D/A signal conversion. • Use filter design packages and determine the response of any specified filter, including specialist types such as adaptive filters, programmable filters, complementary filters and transformations. • Program a DSP to implement a filter for various applications. • Produce a circuit diagram showing how a filter interfaces to a DSP system. • Conduct appropriate tests on equipment used in the CCS network to determine the limitations of DSP techniques. • Diagnose and resolve problems and faults which have been reported in the network related to signal processing. DTMF = Dual Tone Multifrequency. ADPCM = Adaptive Differential Pulse Code Moderation CCS = Common Channel Signalling
600	**EN610**	Enterprise Escalation Procedures 6	Industry recognises a 4 tier escalation system. Candidates at this level will operate at tiers 3 and 4.
600	**EN620**	Enterprise Information Systems 6	Information systems related to obtaining information and recording outcomes for a wide range of operations. Detailed interpretation of the impact of new information on future events.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**EN630**	Enterprise Organi-sational Policy 6	Interpreting policy in workplace interaction with other personnel. Direction of personnel on the basis of policy.
600	**EN640**	Enterprise Alarms 6	Interpretation of alarms and initiation of action in line with policy.
600	**EN650**	Enterprise Operations Policy 6	Covered in EN610 to EN640.
600	**EN660**	Enterprise Pricing Policy 6	Interpreting policy in workplace operations.
600	**EN670**	Selling 6	Interpreting policy in workplace interaction with customers
600	**ET620**	Amplifiers 6	*Assumed – ET520 Amplifiers 5* • Demonstrate specialist knowledge of electronic circuit design of the most complex telecommunication equipment in order to test, analyse, organise repair, predict durability, recognise potential causes of problems and faults. • Design interfacing and waveshaping circuits, select differential amplifiers of suitable characteristics to meet given system objectives. • Assemble, measure and test response to gain and CMMR, output error and the practical difficulties. • Build amplifiers with given piece-wise linear transfer characteristics, refer to some areas of use for such devices. • Test and measure frequency response, compare and evaluate the pros and cons of active and passive filters. • Classes of power amplifiers, their operation suitable applications and efficiency. • Evaluate the performance of large signal amplifier classes. • Voltage and current ratings, aspects of heat transfer related to heat sinking and techniques of overcoming distortion. • Experiment with fully integrated power amplifiers, measure and compare their characteristics and limitations with discrete component amplifiers. • Compare the performance of the device with the data given by the manufacturers specifications. • Apply specialist knowledge of the design of electronic circuitry to devise measurements and tests targeting the response and limitations of circuitry which is known to be “suspect” and “susceptible” to failure. • GPIB controlled test equipment to monitor the response of various devices and equipment.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**IN610**	Interpersonal relationships 6	• Speaking in public • Plan to make an effective oral presentation − impromptu − prepared − formal − informal • Identify the purpose of the address − to inform − to persuade − to introduce − to sell − to entertain • Prepare the presentation − research topic − identify audience prior knowledge, interests, and expectations − write the presentation − rewrite for the ear − practice and revise • Deliver the speech − incorporate relevant and effective audio/visual aids − encourage audience participation where appropriate − present an impressive image through non-verbal communication − overcome anxiety and stage-fright
600	**IN620**	Teamwork 6	• Leadership in teams • Assumed IN320 Teamwork 3 • Plan and prepare for the team to work effectively • Clarify team goals and purposes • Represent the work team to others if required • Differentiate between types of power • Describe different leadership styles and their impact on the flow of communication • Employ strategies to motivate team members where appropriate • Assist team members to identify their roles and tasks • Interact supportively and constructively with team members

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**IN630**	Negotiation 6	Dealing with conflict *Assumed – IN440 Negotiation 4* • Describe the stages or levels of conflict • Identify signs of potential or actual conflict • Prepare a map to identify the issues and needs • Use active listening in conflict resolution • Give feedback assertively • Use communication skills that facilitate constructive responses to conflict in the workplace • Design options for constructive responses to the conflict • Practice and employ different strategies to design options, including: − brainstorming techniques − Dewey Reflective Thinking process − the decision making agenda − divide or channel problem into small pieces − trial and error approach
600	**IN640**	Workplace networking 6	Global networking *Assumed – IN540 Workplace networking 5* • Demonstrate a basic understanding of Australia's international economic and political position • Suggest future world trends that are likely to have significant impact on Australia's international economic and political position • Define the enterprise's current role within this context and speculate to its possible future role • Cultivate a tolerance and understanding for cultural diversity in the workplace at local and global levels
600	**MA610**	Basic Mathematics 6	Minimum • Calculus • Transient/steady state analysis • Fourier Theory • Discrete • Continuous • Database management systems • Data analysis • Normalisation • Selective query
600	**MA620**	Mathematics 6	Minimum • Statistical analysis − Traffic data − Distribution patterns • Traffic tables − GOS, Erlang B • Queuing Theory - applications − Markov chains • Applications of statistical process: MTBF • Hamming Window Spectrum • Database management systems – relational operators

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**MA630**	Mathematical Modelling 6	• Statistical techniques to analyse the presentation of data, determine confidence limits, define, design and perform statistical tests and gather, process and present data. • Methods covered will include 'alpha' levels of confidence, H0 and H1 tests of hypotheses, etc.
600	**NE610**	Network Equipment 6	*Assumed – NE410 Network Equipment 4* Switching network equipment. • Digital Switching System (DSS) manufacturers and their products. • AXE 10 DSS and functions of its main components. • The 5ESS DSS and functions of its main components. • The System 12 DSS and functions of its main components. • The DMS 100/200 DSS and functions of its main components. Transmission network equipment. • Main transmission equipment manufacturers and their products. • The DM2 and DM8 multiplexer/demultiplexer and functions of their main components. • The FLM-150, FLM-600 and FLM-2400 multiplexer/demultiplexer and functions of their main components. GSM network equipment. • GSM network equipment manufacturers and their products. • The DE34 and DF34 BTS and functions of their main components. • The DX200 switching system and how it is implemented in the BSC, MSC/VLR, and HLR.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**NE620**	Network Architecture 6	*Assumed – NE420 Network Architecture 4* Switching network architecture. • Network clock synchronisation and clock hierarchy structure. • Concepts − Fixed routing − Dynamic non hierarchical routing − Adaptive routing. • The technological reasons justifying a distributed control architecture. • Implementation of a Digital Access Cross Connect System (DACS) for electronic cross connection of customers services. Transmission network architecture. • Typical Customer Access Network (CAN) implementation in a CBD fibre ring. • Application of a long distance high capacity 1+1 optical fibre link in a two fibre ring configuration. • Principles behind a layered network architecture. • Meaning of partitioning with respect to connectivity and topology. • Implications of a 'trail' (as defined in the ITU recommendation G.803) in terms of information transfer in a layered network. • Connection point, termination point and access point in a layered network. • Standard diagrammatic symbols defined within the ITU recommendation G.803, used to represent various layered network functionality. GSM network architecture. • GSM network timing configuration. • Implementation of the DE 34/DF 34 BTS, DX200 MSC/VLR and DX200 HLR into a GSM network. • Implementation of new generations of cellular antennas in GSM networks, including: − Variable electrical downtilt − Dual polarisation − Dual band

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**NE630**	Network Signalling 6	Common Channel Signalling Number 7 (CCS 7). • Three types of signal unit at the signalling link level: − MSU − LSSU − FISU. • Functions of signalling network level as signalling message handling and signalling network management. • Four message transfer services provided by the Signalling Connection Control Part (SCCP) and the procedure of connection establishment for the connection-oriented service. Integrated Services Digital Network (ISDN) signalling. • The ISDN User Part (ISUP) of CCS 7 and the difference is between the ISUP and the ISDN call control procedure as defined in 1.451/Q.931. • Functions of the basic services provided by the ISDN user part (ISUP) including: − Calling line identification − Call forwarding − Direct dialling − User-to-user signalling − Closed user groups. Broadband ISDN signalling. • With reference to B-ISDN architecture, the three different sets of signalling interactions and the types of B-ISDN services they are to support. • Referring to the B-ISDN Protocol Reference Model, functions of user plane, control plane and management plane. • How the standard data link control protocol LAPD may be used over ATM. • Virtual Path (VP) and Virtual Channel (VC) connections in ATM and their characteristics as specified by Interim Recommendation 1.450.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**NE640**	Network Management Principles & Capabilities 6	*Assumed – NE620 Network Architecture 6* Network Management models. • The TMN network management model. • The ISO/OSI system management model. • The SNMP network management model. Network management techniques and standards. • Network management techniques and standards used for: − Internet − SDH − ISDN − B-ISDN − GSM Organisation and implementation of a managed data network. • Structure a network management group. • Job functions within a network management group. • Design a managed data network to meet an operational specification. • Locate the best positions for performance monitoring equipment within a managed network. • Demonstrate familiarity with the operation of an element managed system. Fault, configuration, performance and security management. • Identify and diagnose faults in a managed data network and restore services. • Implement adds, moves and changes in a managed network and interact with a configuration management system to maintain a consistent network view. • Interpret performance indicators to identify network performance problems and institute appropriate actions to correct the problems. • Use logging information to identify security violations. • Take appropriate action to end security events. • Institute appropriate follow up actions to remove the security weaknesses in a network.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**NE650**	System Protocols 6	*Assumed – NE620 Network Architecture 6* • International standards setting bodies including: − ITU-TSU (CCITT) − EIA − ANSI − ETSI − ECMA − ISO. • The role of the standards bodies in developing system protocols. Data communications protocols. • Popular data communications protocols including: − X-ON/X-OFF − BSC − ENQ-ACK − SDLC − HDLC − CSMA/CD Ethernet (IEEE 802.3) − Token Ring (IEEE 802.5) − FDDI − GPIB (IEEE.488) − Token Bus (IEEE 802.4) − TCP/IP (Internet) − X.25. Telecommunications protocols. • Protocols used in the following telecommunications networks and their relation to the ISO/OSI model including: − Common channel signalling number 7 − ISDN − B-ISDN (ATM) − Frame Relay (WAN Network) − PDH − SDH. Alarm and network management protocols. • X.25 protocol in alarm networks. • Network management protocols including: − SNMP − TMN.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**NE660**	Network Demographics 6	*Assumed – NE640 Network Management Principles and Capabilities 6* Routing in switched networks. • Given a sketch of a circuit-switched network with alternate routing indicate which routes are high-usage (primary and secondary) trunk groups and final trunk groups. • Cost factor and its use in dimensioning trunk groups. • Principles of dynamic non-hierarchical routing strategy. • Reasons for using routing and the concepts of routing in packet-switched networks. • Nature of traffic on high-usage routes and on final routes. Dimensioning of high-usage and final trunk groups. • Why the traffic on primary routes is assumed to be random, while the traffic on second choice routes and final routes is peaky. • Principles of dimensioning the non-routes and GOS routes. • How the number of circuits in a high-usage trunk group can be estimated by using the ITU-T table indexed by the cost factor R. Calculations of traffic overflow to alternate group. • Determine the total traffic offered to the high-usage trunk group. • Use tables to find the traffic overflowing from the high-usage trunk group. • Calculate the total traffic offered to the trunk group of the secondary route. Mean traffic adjustment calculations. • Calculate the peakedness factor of the traffic overflowing from the high-usage group. • Calculate the weighted mean peakedness factor for a number of parcels of traffic offered to the final group. Evaluation of number of circuits in final group. • Determine the level of day-to-day traffic variations. • Determine the mean traffic offered to the final trunk group. • Using peaked-traffic capacity tables determine the number of circuits in the final trunk group. Reference connections for switched circuits. • Given the diagram of reference connections for a circuit-switched network, identify each component and its functions. • Given a diagram of reference connections for a packet-switched network, identify each component and its functions.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	User demands to traffic variables and signalling traffic evaluation. • Traffic variables in user plane and control plane as specified in the ITU-T recommendations E.711. • The ISDN grade of service parameters.
600	**NE670**	Forecasting Techniques 6	*Assumed – NE670 Forecasting Techniques 4* Blocking in PSTN and GSM networks. • Forecasting traffic requires that a blocking probability that users will tolerate is known. • Compare the following typical Grades of Service (GOS), − 0.002 to 0.05 for PSTN − 0.01 to 0.05 for GSM base station links − 0.002 to 0.001 for GSM switch to PSTN. Dispersion measurements. • Sources and destinations of all traffic are required in addition to traffic volumes to aid in traffic forecasting. • Dispersion measurements involve analysing the called number to typically six digits and recording the total holding time. • Dispersion measurements provide a matrix of the originating traffic from a switch to provide the basis of traffic forecasting. Traffic forecasting models. • The meaning and the use of base data for forecasting of traffic. • The curve fitting models that are used to extrapolate traffic trend: − Erlang-B − Erlang-C − Poisson − Engset − IEL − GV. • For a given base data and the analysis model predict the traffic for the next: − Two years − Decade. • Calculate the traffic intensity during a given period of observation. • Provision the components of a loss system to meet a given GOS using Erlang-B formula. • Provision the components of a delay system to meet a given GOS using Erlang-C formula.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**OH610**	Occupational Health & Safety 6	*Assumed – OH510 Occupational Health & Safety 5* • Processes, procedures and documentation to satisfy all the requirements of the Occupational Health & Safety legislation relevant to the workplace. • Organise and select appropriate staff for First Aid training, and major functions of safety committees and representatives. • Prepare a brief and ongoing safety awareness training program for the work force. • Evaluate site area and project plan, note all the safety aspects; list safety equipment required, resources and skills needed and precautions to be taken. • Generate an OH&S job specification to be included as a task associated with the project. Discuss as appropriate with builders and planners. • Provide a report to be included as part of the project plan. • Monitor workforce personnel on a regular basis. • Keep records in relation to their health, occupational incidents, skills and capacity to perform their job safely to self and others. • Manage appropriate training and re-skilling where necessary. • Keep current records of legislation, codes, regulations and standards which relate to the enterprise work activities including: − Fire Regulations − OH & S − Environment Protection Act − Building Codes − Telecommunications Act and associated codes.
600	**PE610**	Personal Skills 6	Covered in PE510 Personal Skills 5
600	**PE620**	Decision Making 6	Planned problems solving methodology • Recognise strategic, administrative and operational types of decisions • Describe the decision making process − Identify the need for a decision − Define the problem − Clarify the objectives − Collect data − Generate alternatives − Evaluate alternatives − Make decision − Implement and monitor decision made. • Make informed decisions by taking all relevant factors into account.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Investigate and apply the use of models in the decision process including: − Breakeven model − Payoff tables − Expected value − Decision tree − Ishakawa diagrams − Force field analysis − Statistical process control • Foster collaborative thinking and creative problem solving by using Edward de Bonos' "Six Thinking Hats". • Define a number of problem solving alternatives for given individual and team situations.
600	**PK610**	Product Knowledge 6	• Features, functions and limitations of products related to competency unit. • Maintenance routines appropriate to effective operation of products. • Relative performance capabilities of alternative products.
600	**PR610**	Problem Solving 6	Covered in PR310 Problem Solving 3
600	**PR620**	Logic	Refer to PR310 Problem Solving and relevant Enterprise Operation Policy & Enterprise Escalation Procedures
600	**PS610**	Plans & Specifications 6	Covered in PS510 Plans & Specifications
600	**PS620**	Design 6	*Assumed – PS430 Drawing Techniques* • Identify requirements − Change, improvement, network plan, specific goals − Demand network growth − New technology features, innovation and development − Trend analysis − Statistical data • Planning options − Present and future needs − Cost/benefits − Outcomes/priorities − Approval • Specifications − Location, route, area, product, platform − Cost estimates, budget, profit − Enterprise policy − Commercial strategies − Project timing

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Prepare brief − Resources: skills, equipment, hardware/software − Scheduling − Maps, sketch plans − Description of project • Quotation − Tenders − Assessment • Progress − Monitor, control, liaise − Contracts − Variations − Quality • Contingency plans • Completion
600	**PS630**	Drawing Flowcharts 6	• Project brief • Site inspection, tests and measurements • Equipment/system needs, availability, reconfiguration • Project tasks − Work breakdown − Networking of tasks • Plan − Priorities − Timeframe − Resources − Approvals • Software and computer literacy − Flow charting packages − Gantt charts − Process flow charts • Critical path − Contingency plan − Monitor impact of change − Modifications
600	**PS640**	Spare Parts Dimensioning 6	• Equipment categories − Analogue − Digital − Test gear and tools • Levels of repair − 'Black box' replacement − Swap equipment/board − Component level • Running costs − Storage, personnel, records (data base) − Stock levels − Shelf life, turnover • New technologies − Suppliers − Availability − Forward planning • Enterprise policy

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**PS650**	Telecommunications Equipment & Systems Design 6	*Assumed – PS620 Design 6* • Design requirements − Needs − Specification • Australian electrical and safety standards − ISO9000/9001 − TS14, ITU − OH & S • Planning and Development − Hardware − Software − Construction • Trial and Test regime − Test coverage − Interpretation, validity − Impact on existing equipment − Recommendations • Solutions to problems − Diagnosis − Elimination of causes − Changes to specifications • Documentation − Hardware and software details − Specifications − Operation − Product functions − Test results - variances, outcomes

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**PS660**	Topography 6	• Trending data − Demographic changes, population, transport − Economic market, industry trends, sales − Land developments, planning, re-zoning − Technology changes and developments − Traffic patterns, demand • Data collection from: − Customers − Internal organisational, traffic management − Marketing, economic planners − Real estate agents − Sales organisations • State and Federal governments, statutory bodies • Methods of data collection − Network management tools − Reports, maps, plans − Interviews − Directories • Forecasting techniques − Software packages − Appropriate data − Compile figures − Interpretation • New developments − Commercial − Industrial − Domestic • Reviews − Technological change − Demand increases/decrease − Services enhancement − Traffic changes
600	**PS670**	Town Planning Procedures & Practices 6	*Assumed – PS660 Topography 6* • Data collection − Demographic changes – local, national, (international) • Contacts network − State and federal government − Statutory bodies − Shire councils − Real estate agents • Legal factors − Relevant legislation − Codes of practice − Regulations and standards • General forecast − Future traffic and service requirements • Planning initiative − Enterprise policy – planning − Proposal to appropriate organisations

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**PS680**	Basic Building Trades Knowledge 6	*Assumed – PS220 Basic Building Trades 2* • Documents − Plans − Drawings − Specifications • Materials and products − Availability − Cost • Work categories − Tasks − Networking of tasks • Contractors and sub-contractors − Labour contract − Price contract − Variations to task/contract − Timely completion of task − Performance and capabilities − Quality assurance • Inspections and acceptance − Recognised bodies
600	**RA610**	Antennas 6	Microwave antenna systems. • Reasons for upgrading microwave antenna systems. • Variable factors in antenna parameters: − Gain − Front-to-back ratio − Cross-polar response − Polarisation − Bandwidth − Physical size − Weight − Wind loading. • The physical separation requirements for a space diversity antenna system on a radio tower. • The need for physical space when adding microwave antennas to a tower and if space is limited, possible conversion to dual band antennas. • Radio tower and antenna considerations of pollution, corrosion, snow, rain, heat and lighting protection. • Need for tower strengthening if wind loading of antennas is excessive. • Calculate wind loading effects on a radio tower. Cellular antenna systems. • Reasons for upgrading cellular antenna systems. • Variable factors in antenna parameters including: − Omni directional gain − Directional gain − Bandwidth − Beamwidth (horizontal and vertical) − Polarisation (usually vertical). *Cont'd*

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Differences between directional sectorised antennas and panel antennas including: − Physical size − Wind loading − Gain − Bandwidth − Beamwidth − Aesthetic appeal. • Reasons for downtilt. • Electrical downtilt and mechanical downtilt. • Merits of diversity reception using two vertically spaced receive antennas or two horizontally spaced receive antennas. • Use of a single panel array incorporating vertical separation between two receive antennas, one vertically polarised and the other horizontally polarised. • Need for system balance. • Requirements for antennas in umbrella cells. • Radiation characteristics of leaky coaxial cable. • Effectiveness of yagi antennas and leaky coaxial cables in various situations. • Intermodulation and possible causes at cellular antenna locations.
600	**RA620**	Radio Frequency Theory & Hazards 6	Planning a radio network. • Radio site considerations including, availability of power, all weather access, environmental concerns and site costs. Radio system design. • Performance and availability objectives. • Path profile investigation between two antennas. • Possible obstructions in path profile between antennas, such as buildings or trees. • Path clearance using 'k' factor for earth bulge. • Path clearance using Freznel zones. • Calculate link budgets and fade margins. • Frequency and polarisation choices. • How interference from other radio networks can be reduced. • Why multiple hop microwave systems should be installed in a zigzag manner. Radio link reliability. • 'Multipath or frequency selective' fading. • How space diversity, or frequency diversity, or a combination of both can reduce the effects of multipath fading. • How the use of twin-path, hot standby or N+1 arrangements can improve reliability. • Methods to combat vandalism.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
			• Possible power backups in the events of mains failure (include battery, solar cells, diesel motor generator set). • Possibility of local arrangements to connect trailer mounted motor generator set to external connection on radio hut if mains power lost for extended time periods. • Need for air-conditioning in radio huts. • Need for remote alarms at unmanned radio sites. Radio link availability. • Causes of outages. • Flat (rain) fading effects if frequency above 10Ghz. • Outages from noise and interference.
600	**RA630**	Mobile Equipment 6	GSM system architecture. • Block diagram of a GSM network interconnected into the PSTN. • Terms – GMSC, EIR, HLR, VLR, AC, OMC, MSC, BSC, BTS and MS. • Interconnection of the GSM network. Air Interface • Data structures, slot, frame, multiframe and hyperframe. • Logical channel types. • Synchronisation procedure and timing advance. Mobile station equipment. • SIM card and IMSI. • Power control of the MS transmitter. • GSM frequency spectrum usage. • Burst structures used in GSM. GSM call setup. • Mobile registration procedure. • Call establishment procedure. • Mobile station handover between BTSs, BSCs and MSCs. Security parameters. • 'Authentication' procedure. • GSM ciphering and the application of keys and algorithms. • TMSI. Layer 1 – The Physical Layer • FDMA, TDMA, SDMA as applied to GSM. Layer 2 – The Data Link Layer. • The Data Link Layer. • The four different frame formats used in Layer 2 GSM. • The four different fields used in Layer 2 GSM.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Layer 3 – The GSM Network Layer. • The Radio Resource Management sub layer. • The Mobility Management sub layer. • The Connection Management sub layer. Mobile station testing. • Connect a GSM mobile station to a GSM mobile station test set and prepare for testing. • Perform basic tests to confirm operation of GSM mobile station. • Perform advanced tests on a GSM mobile station to evaluate operating parameters.
600	**RA640**	Mobile Traffic Management Principles 6	*Assumed – RA630 Mobile Equipment 6* Free space propagation. • Calculate FSPL, EIRP and electric field strength over typical GSM radio paths. • Compare point to point and propagation prediction models. • Fading variables. • Fading countermeasures. GSM frequency spectrum. • Determine the effects of noise, FSPL, obstruction effects and noise on GSM spectrum. • Compare GSM spectrum performance in rural and city environments. • The reason for 35km maximum range with GSM. GSM cellular radio system basics. • Concepts of cellular radio frequency reuse. • Network planning of GSM cellular networks as capacity increases. • Operation of micro cells and umbrella cells. • Interference management of GSM cellular systems. • Calculate cell radius re-use distance. • Methods of increasing traffic capacity. GSM Network Management. • Frequency hopping. • Remote software down loading to GSM radio sites. • Evaluation of busy hour traffic measurements. • Evaluation of quality of service measurements. • Evaluation of availability measurements. • The self checking nature of the GSM network. • The role of the Operations and Maintenance Centre. • The role of the Network Management Centre. • The role of the Administration Centre.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Computer Simulation tasks. • Determine the predicted co-channel interference using a simulation program. • Determine the predicted path loss using a simulation program. • Find the predicted traffic capacity given the necessary data using a simulation program.
600	**RE610**	Laws, Policies & Guidelines 6	Covered in RE410 Laws, Policies and Guidelines
600	**RE620**	Physical Interface Standards 6	Covered in RE520 Physical Interface Standards 5
600	**RE630**	Land Acquisition 6	Covered in RE430 Land Acquisition 4
600	**RE660**	Australian Electrical Standards 6	Refer to Australian Standards Review context of competency unit and relate to relevant standards.
600	**RE670**	ITU & International Agreements 6	• Role of ITU • ITU recommendations • International roaming agreements and applications
600	**SC610**	Science 6	Covered in SC510 Science 5
600	**SU600**	Tender Analysis 6	• Review of tender specifications • Setting analysis criteria • Applying analysis criteria • Factors affecting successful outcomes
600	**SU610**	Planning 6	Covered in SU510 Planning 5
600	**SU620**	Leadership 6	Covered in SU520 Team Leadership
600	**SU630**	Quality Management 6	Covered in SU530 Quality Management 5
600	**SU660**	Finance 6	Covered in SU460 Finance 4
600	**SU670**	Project Management 6	• Overview of project management • The three phases of project management • Roles and responsibilities within project management • Two project management tools - software • Project contract documents • Project progress – representation, tracking, budgeting • Contingency plans
600	**SU680**	Resource Management 6	• Fundamentals – labour, finance and materials • Project evaluation – resourcing assessments • Training requirements • Tendering processes • Project budgeting/costings checklist • Contingencies • Critical path analysis in the resources chain

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**SU690**	Economics & Strategic Thinking 6	• Industry advice indicates that this type of skill and knowledge is provided to enterprises by individuals with degrees and higher degrees.
600	**SW620**	Packet Data Switching 6	X25 Packet Details • Packet types used in X25 virtual channel communications and how they are employed. • The different fields in X25 packet headers and explain their functions. LAPB Details • HDLC frames used in link layer supporting X25 packet layer. • Different fields in the HDLC frame header and explain their function. Fast Packet Switching - Frame Relay • The limitations of X25 in handling high speed, real time communication required with ISDN. • Advances in reliable transmission technology that allow reduced overheads in packet switching. • How frame relay, driven by N-ISDN, was conceived to overcome restrictions of conventional packet switching. • Compare X25 and frame relay overheads and overall efficiencies. • Frame relay architecture at user - network interface and call control procedure. • Compare processing functions for X25 and frame relay. • Frame relay congestion control features. • Packet Switching on ISDN • The packet switching provision in N-ISDN, including channel or B channel packet services. Asynchronous Transfer Mode (ATM) Switching • The concept of virtual path and virtual channel. • Characteristics of ATM cells that allow shortcomings of X25 and frame relay to be overcome for B-ISDN applications. • The elements of the cell header and their function. • The network management functions provided by OAM cells. • Operation of ATM switches, including multislot, multipath switching and describe how variable cell delivery delay can be controlled to acceptable limits for real time voice or video applications. • Approaches of major switch manufacturers, Nortel, Alcatel, ATT to integrate ATM switching (B-ISDN) with 64Kb/s N-ISDN switching into their products.

LEVEL	CODE	TITLE	CONTENT GUIDELINE

600	**SW630**	Switch Networks 6	Narrow band ISDN structure / operation details
			• ISDN protocol architecture for user-network interface and intra-network interface. Services provided by ISDN. ISUP signalling protocol to carry ISDN services across the network. Implications to the network of the different bearer types that can be carried as part of ISDN bearer services. Call set-up signalling procedures.
			Digital Switching and System Software
			• Software architecture of digital switching systems, identifying major functional modules. The evolution of switching software technology and design process. Functions of Operating System, Call Handling, Administration and Maintenance software. Intelligent Networks. Aims of an Intelligent Network. The four planes of IN conceptual model. Physical components of IN. Functional components of IN. The historical evolution of IN concept. IN services provided in Australia. Operation of freephone, VPN, card calls and other IN services. Service creation concept of IN, using SIB's. Advantage and limitations of service provision by IN. Signalling function, using CCS7 / TCAP to support IN. Role of adjuncts and service node.
			Operate a Protocol Analyser
			• Use a protocol analyser to analyse a protocol interaction, such as ISUP, SS7/TCAP, TUP. Flow diagram for a recorded period. Signalling messages of a normal call set up. Configure information elements of a signalling message. Emulate signalling procedures: DSSI, TUP, ISUP, TCAP. Signalling procedure of a call set up.
			Digital Switching Systems Architecture
			• Technological reasons justifying a distributed control architecture. Major DSS manufacturers and their products, worldwide and in Australia. Architecture and functionality of main components of the including following DSS's:
			  ◦ ATT's
			  ◦ 5ESS
			  ◦ Nortel's DMS Supernode
			  ◦ Ericcson's AXE10
			  ◦ Alcatel's System 12.
			• Main features, in areas of switch matrix design, system control, network interface, remote subscriber units, control and switch block security.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**TE610**	Telephony Principles 6	Digital ISDN Telephone. • Block diagram of an ISDN telephone with the following functional blocks − PWC − SIC − DCC − AIU − MEU − MPU − KBU − DIU, − SP. • Basic function of the blocks and what ISDN layer they operate at. • Advantages and features that are provided by this type of digital telephone. Digital PABX Principles. • Main differences between a digital PABX, and previous generation PABXs. • Block diagram of a typical digital PABX showing the major components including: − Time Division Switch (TDSW) − Port Interfaces − Port Micro controllers − Central processing Unit − Memory − The Man-Machine Interface. • The user functions that are available using a digital handset connected to a digital PABX. • The purpose of connecting a Telephone Information Management System (TIMS) to a PABX. • Types of reports that can be provided by the TIMS. Virtual Private Network (VPN). • Virtual Private Network such as Centrex or CustomNet. • Main features of a virtual private network and what impact this private network has on the PABX industry. • Advantages and disadvantaged this system may have compared to an ISDN based PABX facility.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**TE680**	Cmts 6	GSM Radio Link. • Terms − FDMA, TDMA as used by cellular mobile radio as a multiple access technique. − Uplink and Downlink frequencies when referring to the duplex transmission used on the mobile phone system. GSM Network Planning. • How frequencies are used and reused. • How channels are assigned to cells. • Define − Adjacent channel Interference − Co-channel Interference, − Dispersion or Reflection mean. • How a radio survey can be used to monitor the performance of the network by using a vehicle fitted with mobile radio equipment and Global Positioning Satellite System (GPSS).. • Operation of micro cells and underlaid cells. GSM Evaluation Tests. • Perform advanced tests a GSM mobile station using a test set to evaluate its performance characteristics. • Measure transmitter carrier power and frequencies on all channels of a base station. • Measure BER at all receivers of a base station using a loop back mobile station. • Determine the predicted − Co-channel interference using a simulation program. − Path loss using a simulation program. − Predicted traffic capacity given the relevant data and using a simulation program. GSM Enhancements. • Main features of Low Earth Orbit Satellite (LEOS) cellular radio. • Main features of the DCS1800 (1800MHz) system and the need for dual-band cellular mobile phones.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**TF610**	Test Equipment 6	Network analysers. • Features of scalar and vector network analysers. • Typical parameters, such as, frequency range, resolution, dynamic range, sensitivity and time domain options. • Applications of network analysers in telecommunications, such as, group delay, swept measurements and transmission losses/gains. • Search on captured data from the output of a network analyser (SDH, CCS#7, PDH). • Simple "hand" disassembly of a captured frame from a typical network analyser (PDH, SDH, CCS#7, X25) of at least 256 bits in length. PDH network analysers. • Features of a typical PDH network analyser, such as BER, jitter, wander, bit rates and network alarms. • Tests to be carried out in-service and out-of-service. • Telecommunications network equipment which can be tested using PDH network analysers. SDH network analysers. • Features of a typical SDH network analyser, such as, BER, jitter, wander, bit rates, WDM, add/drop PDH payloads and network alarms. • Tests to be carried out in-service and out-of service. • Telecommunications network equipment which can be tested using SDH network analysers. ATM/Frame Relay network analysers. • Features of typical ATM/Frame Relay network analyser, such as, injected cell impairments, cell measurements, alarms, errors and frame relay interworking. • Tests to be carried out in-service and out-of-service. • Telecommunications network equipment which can be tested using ATM/Frame Relay network analysers.
600	**TF620**	Test Analysis & Diagnosis 6	Transmission network impairments. • Clock signal impairments. − Categories of clock signal impairments including frequency offset, clock noise, phase variation, regenerator jitter, diurnal wander, and desynchronised justification jitter. • Sources of errors in transmission networks. − Main sources of errors in transmission networks including thermal noise, aging lasers, radio fading, electrostatic and electromagnetic interference in radio systems, high resistance connections, timing impairments and low marginal design criteria. Transmission error detection in SDH networks. • Mechanisms for error detection in SDH including, loss of frame phase and block error monitor.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Stress testing of transmission networks for test analysis. • Merits of stressing networks elements by performing tests including, frequency offset, wander, auto-jitter tolerance, auto-jitter transfer and output jitter measurements. Error performance. • Error analysis methods in use or being developed including, error seconds, error free seconds, severely errored seconds, degraded minutes, unavailable seconds, threshold error seconds, background block errors, unavailable time and short interruption event. Transmission network availability. • Mean Time Between Failures (MTBF) - the mean time to the first failure only. • Manufacturer supplied MTBF not standardised on MTBF measurement. • Mean Time To Restore (MTTR) • Availability • Unavailability.
600	**TF630**	Fault Finding 6	Blocking in GSM. • Blocking (or sealing) - term used for a channel temporarily taken out of service by the base station controller. • Blocking - occurs while the channel is in use or when it is on standby. • Most probable cause of blocking - interference from another mobile. • Blocking kept below 2% – considered normal. Greater than 5% tends to indicate system design errors, intermodulation problems or RF interference from other equipment. • Poor system design can cause blocking by allowing excessive overlap between cells and the mobilephone may end up on a distant co-channel station because of local congestion and hence cause interference to a local station. Advanced system fault finding. • Advanced fault finding begins in the network operations centre. • The collection of databases and support tools available in the network operations centre, such as, equipment, locations, services, circuits, cables, customers, bills, faults and alarms. Fault finding in the network at the network operations centre. • Basic fault finding approach in the network.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**TF640**	Radio Tests 6	Microwave link commissioning tests (advanced). • Sweep measurements. • Return loss. − Measure return loss of all antenna/feeder combinations using a directional coupler. • Transmitter IF/RF spectrum. • Measure all modulated transmit IF and RF spectrums. • Measure spurious transmitter output • Measure all transmitter outputs for harmonics and intermodulation products. Protection switching. • Check correct functioning of switching and redundancy equipment. • Check 'hitless' switching if fitted. Add/drop multiplexers. • Check correct functioning of all add/drop multiplexers. GSM base station commissioning tests (advanced). • Sweep measurements. Return loss. − Measure return loss of all antenna/feeder combinations. • Transmitter RF spectrum. − Measure transmitter RF spectrums whilst modulated. • Transmitter spurious measurements. − Measure all transmitter outputs for harmonics and intermodulation products. Transmitter ramp measurements. • Perform mask test for transmitter ramp on/off power envelope. Miscellaneous tests. • Check all redundant equipment for correct operation. • Place test calls and have them traced and monitored by the switch
600	**TF690**	Advanced Diagnosis 6	Automated management systems. • Each telecommunications equipment supplier has their own management system. • Each carrier has to build their own management system to integrate the systems from several suppliers. • ITU is trying to produce a standard network management model that is common to all suppliers equipment. Operation Support Systems (OSS). • Purpose of the OSS is to provide people with the information about the network that they need. • OSS ties together the network design, configuration and maintenance.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• OSS allows a large telco network to be managed in an integrated way by providing information for marketing, and statistics for planning. • OSS provides the commonality between management tools and alarms supplied by equipment suppliers. • OSS links three main elements, customer service, network operations and network planning. • Trouble reporting is passed to network operations fault management via customer service. Network operations. • Network operations oversee the operational status of the whole telecommunications carriers network. • Five key areas in network operations that provide information for advanced fault diagnosis: − Trouble handling − Surveillance − Traffic monitoring − Switch management − Transmission management. Trouble handling. • Systems in place regarding customer complaints, problem analysis, remedial action and reports to customer. Surveillance. • Various alarms which are collected from network switching and transmission equipment. Traffic monitoring. • Merit of collecting and analysing information regarding voice and data traffic capacity. Switch management. • Detection of abnormal conditions in network switching and remedial action. Transmission management. • Detection of abnormal conditions in network transmission and remedial action.
600	**TO610**	Use Of Tools 6	Safety with optical fibres. • Basic safety precautions when working with optical fibre: − Do not look into the end of a fibre unless absolutely certain a laser is not connected to the other end. − Do not touch the end of a glass fibre as a small splinter of glass may pierce the skin and ultimately enter the blood stream. − Do not touch epoxy (used in connectors) as it is a hazardous chemical.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Fibre-optic hand tools. • Common fibre optic hand tools used for splicing and fitting connectors to optical fibre − Crimpers − Buffer strippers − Cleavers − Mechanical/finger splices − Inspection microscopes − Polishing pucks − Cable strippers − Fusion splicers • Correct techniques for using fibre optic hand tools. Fibre optic connectors and splices. • Why splices are preferred in the field compared to the fitting of connectors. • Desirable features of a connector or splice, such as, − Low loss − Easy installation − Repeatability − Consistency − Economy • Correct techniques to: − Mechanically splice two ends of optical fibres together. − Fusion splice two ends of optical fibres together. − Install a sc connector on a 0.9 mm buffered − Optical fibre patch leads • SC connector for correct polish and finish.
600	**TO620**	Anti-Static Procedures 6	Lighting protection for radio antennas. • Principles of lighting protection − Low resistance path to ground for a lighting strike − A lighting conductor at the highest point on a tower. • "Zone of protection" of a lighting rod − All protected antennas to be within the cone. − Lighting rods not to interfere with antenna radiation patterns. Lightning protection for antenna feeders. • Antenna feeders, co-axial and wave guide to be earthed at, − Top of tower − Bottom of tower − Entry point to building. Lightning protection for radio towers. • Earth each tower leg to separate grounding rods − Connect together with a buried bus-bar and then connect to building earth.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Grounding techniques. • Underground earth connections to be welded together rather that bolted. • All grounding conductors to be solid copper straps. • Directly connect lightning rod should be to ground via its own solid copper strap. • Avoided sharp bends in earthing straps. • Ground resistance should be less than 5 ohms. • Internal grounding. • Ground equipment racks to a common bus-bar but the bases and insulate from the floor • Earth able trays at several points. Total equipment protection. • Additional protection required at radio site − Protect all power lines entering building − Protect all data cables and land lines entering building.
600	**TR610**	Transmission Theory 6	Digital • Requirements for digital transmission • Advantages and disadvantages of codes. • Mechanisms of degradation and of control of digital signals on transmission lines • DCPM, PM • DSI systems • BER vs S/N requirements Measurements • Representative PCM tests • Errors in measurements • Jitter measurements • Test procedures related to measurement methods. Systems • SDH, PDH, ATM • Representative digital transmission schemes. • ISDN implementation. • Analyse a number of recent developments in transmission techniques.
600	**TR620**	Light/Laser Theory 6	• A range of Photonic components • Solitons, Chromatic dispersion and advanced theories of light. (Quantum theory) Fibre Optic Concepts • WDM and TDM systems • Optical fibre performance vs fibre characteristics • Fibre optic system implementation using a performance specification Photonics • Analyse a range of Photonic devices. • Analyse modern optical systems using Photonic components

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Laser/Leds/detectors • Compare three laser types • Practical performance limitations • Typical detectors • Principles of operation of detector types and their limitation Systems • Practical optical fibre systems such as SDH • System margins and data rates • System test methods Measurements • OTDRs, power measurement, attenuators and OSAs. • Principles and limitations of optical measuring equipment.
600	**TR630**	Modulation Theory 6	Communication Theory • Analyse types of interference to communication Digital Modulation • Digital modulation schemes • Efficiency of modulation methods for information transfer, bandwidth and performance in the presence of noise. • System requirements for modulation systems • Effects on digital signals of presence of noise and interference TDM • Different approaches to multiplexing and methods of framing, signalling and error correction. • Typical system applications. Spread Spectrum • Advantages of spread spectrum systems • Performance of typical spread spectrum systems. Advanced Modulation Schemes • Performance of TDMA, CDMA Systems • Satellite systems, Local Area Networks (LAN) and GSM • Performance of satellite systems, GSM, LANs and other modern implementations.
600	**TR640**	Narrow- & Wideband Principles 6	Spectrum Utilisation • Spectrum of various modulation schemes including raised cosine, PSK, OOK, QPSK, MSK, FM using a computer program. • MSK and GMSK as a modulation method versus FM and/or PSK • Features and advantages of CDMA systems • Walsh codes

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Satellites • Satellite based transmission systems and their operating principles. • Uplink and downlink frequency bands and the differences in transmission power. • Determine the various orbital relationships, receiver/transmitter power levels and antenna area coverage. • Range of frequency bands being used in satellite systems and how they are allocated on an international basis. • Satellite link budget calculations. Transmission Impairments • Source of transmission line echo and its adverse effects. • Difference between speaker and listener echo paths and which of these is usually most severe. • Echo suppressors used with reference to the ITU recommendation G.164. • Compare echo suppressors. • Operation of echo cancellers with reference to the ITU recommendation G.165. • Simple adaptive echo canceller performance characteristics using a simulation package such as MATLAB. • Problems and recommended solutions of echo cancellation when modems are used to transmit data over a normal telephone voice channel. • Need for channel equalisation • Adaptive channel equalisers and what benefits they yield.
600	**TR650**	Traffic Management 6	Basic Principles • Equations of State • Queuing problems using the equation of states. • Program to simulate a single server, single queue packet system (i.e. a discrete event simulation tool) Traffic Load Design • Traffic management design software tools (e.g. Westbay) to model and dimension a voice network • Problems involving available numbers in a numbering plan by calculator and computer simulation. • Network delays and throughput for a simple ATM network. • Number of agents required to maintain a particular grade of service at a call centre using Erlang B and C loss functions • Growth of the traffic in a network by using the least squares method and fitting the growth to a linear and/or an exponential equation.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	Management Functions • Typical day to day variations and seasonal variation in traffic flow in order to prepare a traffic management plan to improve the traffic flow (maximise revenue) • Typical traffic management functions performed on a day to day basic by network operations staff.
600	**TR660**	Spectrum Management 6	Radio Spectrum Characteristics • Propagation characteristics of the commonly used mobile radio bands. • Calculate expected coverage areas and field strengths for defined transmission parameters. • Principal modulation techniques used in mobile radio communications systems and calculate various performance parameters. Media Access • Channel access and resource sharing techniques vs spectrum limitations • Propagation impairments to be overcome in the design of mobile communications systems. • Techniques used to solve the problem of impairments on the radio transmission medium. • Calculation improvements available through the application of various diversity techniques. • Key characteristics of systems in terms of their technical implementation, as distinct from service functions. • Technical characteristics and performance limitations of systems related to their location within the radio frequency spectrum. Radio Path • Simulation program of carrier to Interference ratio for a simple cellular re-use • Effects of antenna height and reflection coefficient on receiver signal strength at a particular frequency • Ways of reducing fade in a typical cellular radio system. Spectrum management for maximum return on investment • Business plan to purchase spectrum for a cellular system based on potential revenue by using a modern simulation program (e.g. Crystal Ball Pro for Excel) using at least two different cell size scenarios. Best and worst returns on investment.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
600	**TR670**	Transmission Technologies & Products 6	Practical • Configure an FLM150 (or similar) for an AddDrop configuration in a network using the appropriate configuration software. • Configure a sub rate digital multiplexer for data service on a 2 Mbps service. Technology and Product Research (current) • List at least 10 major vendors of transmission products • Compare two products and recommend one for purchase given network specifications and requirements. • Commonly used criteria for selection of transmission products and rank these criteria (at least 8 criteria required). Technology and product research (new and emerging technologies) • Features of ADSL and xDSL transmission technology • WDM and optical Amplifier technology • UMTS systems.
600	**TR680**	Transmission Hierarchy 6	PDH and SDH • PDH characteristics. Limitations of PDH in terms of present and future transmission system requirements. Functional architecture of transport networks based on Synchronous Digital Hierarchy (SDH) and its characteristics. Functional relationship between SDH and SONET. Features of synchronous digital hierarchy (SDH) and SONET. SDH • The SDH frame structure including: − Synchronous transport modules. Tributary units. Tributary unit groups. Administrative units. Pointers. Section overheads • The SDH-based multiplexing process • Structural configuration of SDH layered transport networks • Sources of timing errors in both PDH and SDH transmission networks. • Terms used within an SDH transport network: Phase variation. Regular clocks. Gapped clocks. Frame phase. • Characteristics and sources of various timing impairments including, frequency offset, clock noise, quantised phase variation, regenerator jitter, diurnal wander and desynchronised justification jitter. • Administrative and tributary unit pointers mechanisms • Overcoming clock impairments.

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Structural configuration of clock synchronising networks for PDH and SDH. • Transmission system performance • Monitoring capabilities and mechanisms available for establishing SDH transmission network performance. • General transmission network performance parameters including error performance and availability measures. • Sources of transmission error and their relative importance in an SDH network. • Transmission error detection mechanisms available within SDH including loss of frame phase and block error monitor. • SDH based error performance and unavailability parameters and how they are determined. ATM • Functionality and implementation of transmission systems based on Asynchronous Transfer Mode (ATM). • Components of an ATM cell and the function of each component. • Bit Error Rate (BER) requirements of a transmission system required for successful use by ATM. • Relationship between ATM service classes and ATM adaptation layer functions. • Transmission options for ATM and their associated framing and coding characteristics. • Cell delineation for each of the available ATM transmission options.
600	**TR690**	Transmission Test Instruments 6	• Levels of a system, levels of documentation and test documentation in a system • Maintenance and testing documentation • Acceptance test and ongoing testing • Quality systems • Maintenance philosophies • Test programs based on logistic inputs • Testing terminology • Calibration programs • Standards systems and relationship to quality systems • Test procedures and measurements, reports and recommendations • System measurements and testing errors • Implement a test setup • High level transmission test equipment, automatic and manual test systems • Operation and principles of a number of transmission test equipment • Limitations and capabilities of particular approaches to test equipment

LEVEL	CODE	TITLE	CONTENT GUIDELINE
		(continued from previous page)	• Implement an ATE set up • OTDR, power measurement, TDR, OSA, counters, mechanical metrology equipment, BER test sets, sampling oscilloscopes, network analysers, SLMS, data analysers • CCITT recommendation, O series.
600	**VO610**	Video Network Techniques 6	• Set up and commissioning of video distribution systems incorporating a switching element and a network node. • Remote management of the switching element and any other manageable elements connected to the video distribution system. • Set up and commissioning of video distribution networks, including the switching element. • Remote management of the manageable elements of the video distribution network, including the switching element. Sources can include work experience or training laboratory. • Emerging trends in digital video distribution, such as HDTV, etc.
600	**VO620**	Video & Sound Principles 6	Television Transmission Systems • Block diagram of a television transmission system with the following blocks: − Video In (from a variety of sources) − Audio In (from a variety of sources) − Video amplifier, video modulator, modulation amplifier, oscillator − Frequency multipliers, power amplifiers, audio amplifier − Varactor control oscillator and diplexer • Australian Television standards High Definition / High Fidelity Television • Digital Television − Encoding (video and sound) • Time compression of video analogue signals Transmission Mode • MPEG • Signal formats • Block diagram of the format